MINI COLOR SERIES 7521

LAV & PIRANHA

THE EXTENDED FAMILY

Gordon Arthur & Steve Hearn





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Introduction

The engineer Walter Ruf founded MOWAG (Motorwaffenfabrik) AG in 1950, the company achieving immediate success in the manufacture of specialized vehicles for the defense sector. The first Piranha prototype was completed in 1972, and to date more than 9300 Piranhas and Light Armored Vehicles (LAV) have been delivered to 21 countries, with production undertaken in five nations. Nowadays, MOWAG GmbH employs more than 500 personnel at its Kreuzlingen facility in Switzerland. This book examines the Piranha/LAV family of vehicles in service with many nations around the world. However, it does not cover the U.S. Army's Stryker that is covered in Concord's title, 7515 Stryker Interim Armored Vehicle.

MOWAG has produced vehicles in the 12.5-ton to 25-ton class in configurations that include 4x4, 6x6, 8x8 and 10x10, with the most popular being the 8x8. A third-generation vehicle was unveiled in 1996, with this Piranha III being a huge sales success in Europe. A newer Piranha is the state-of-the-art Piranha IV. MOWAG's motto is "Protected Mobility," and this vehicle emphasizes mine protection. It features a 30mm Bushmaster II cannon equipped with a thermal imaging sight, and a 7.62mm coaxial MG in a two-man CTC turret. The Piranha IV is dimensionally larger than its predecessor, and reaches a combat weight of 25 tons. A significant event in the MOWAG story occurred in October 2003 when the Swiss company was incorporated into General Dynamics Land Systems (GDLS).

More recently, GDLS offered a specially designed Piranha V as a contender in the British Army's Future Rapid Effect System (FRES) program. From July to September 2007, the Piranha V competed in trials against a German Artec Boxer and French Nexter VBCI. On 8 May 2008 the UK Ministry of Defence (MoD) announced the Piranha V had been provisionally selected as the preferred design for the Utility Vehicle (UV) variant. Due for introduction in 2012, this fifth-generation Piranha offers increased payload, protection and mobility.

GDLS-Canada has also unveiled an LAV-H High-Capacity Technology Demonstrator, in response to greater operational requirements for enhanced survivability, armor, payload and mobility. It has a new power pack, upgraded driveline, suspension, brakes and steering, as well as open vectronics architecture. The 25-ton test platform is based on a LAV III, so it maintains commonality with the Stryker and LAV.



An 8x8 Piranha IIIC fitted with a 25mm M242 Bushmaster cannon shows off its amphibious prowess in a Swiss lake. The automatically operated bow trim vane is raised, and twin propellers at the rear propel it to a top speed of 10km/h. (MOWAG)



A 10x10 MOWAG Piranha IIIC demonstrator boasting a stabilized two-man turret offering -6° to +27° elevation for a 40mm Bofors AK/40 L70B gun. This weapon has a rate of fire of 300 rounds per minute. (Bofors)

Technical Specifications of MOWAG Piranha 8x8

	Piranha I	Piranha II	Piranha III	Piranha IV
Length	6.3m	6.8m	6.96m	7.24m
Width	2.5m	2.63m	2.66m	2.8m
Height (top of hull)	1.9m	1.9m	2.17m	2.2m
Gross weight	9.5 tons	10 tons	12.5 tons	15 tons
Maximum payload	3 tons	4 tons	6 tons	10 tons
Useable internal volume	8.5m³	9m³	11m³	13.2m³
Maximum range	540km	660km	500km	750km
Maximum speed	80km/h	100km/h	105km/h	100km/h
Crew + passengers	5	3 + 6	3 + 8	3 + 8
Engine	275hp Detroit Diesel 6V53T 6-cylinder	275hp Detroit Diesel 6V53T 6-cylinder	400hp Caterpillar C9 3126 diesel 6-cylinder l	544hp MTU diese
Typical armament	1x .50-cal MG	1x M242 25mm cannon 1x 7.62mm coaxial MG 1x 7.62mm MG	1x M242 25mm cannon 1x 7.62mm coaxial MG 1x 7.62mm MG	1x Bushmaster II 30mm cannon 1x 7.62mm coaxial MG



The Piranha IV is larger in every respect, though it can still be transported by C-130 aircraft. The Piranha IV mounts a 30mm Bushmaster II cannon and coaxial 7.62mm MG in the turret. No nation has purchased this vehicle yet. (MOWAG)



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This 8x8 Piranha Evolution is undergoing trials at Bovington for the British Army's FRES requirement for more than 2,000 Utility Vehicles (UV). The final Piranha V will likely differ when it is finally rolled out. (GDLS)

A Piranha IV speeds across the Swiss firm's proving ground. To cope with the extra weight, this latest model is powered by a 544hp MTU diesel engine. MOWAG claims the Piranha IV has 45% greater mobility than the original Piranha I, while its armor can withstand 30mm AP rounds. (MOWAG)

Canada's introduction to the MOWAG Piranha resulted from a Request for Proposals (RfP) issued by the Canadian Armed Forces in June 1974. Canada required an amphibious multirole armored vehicle for use by Regular Force and Militia units. Following extensive field testing of three different vehicles, the MOWAG Piranha 6x6 was declared the winner. In January 1977 a production contract for 350 Armoured Vehicle General Purpose (AVGP) was awarded to the Diesel Division of General Motors (GM), which built vehicles under license at its plant in London, Ontario. The first vehicle was officially handed over on 23 January 1979. The initial order involved three variants: 152 Cougar Wheeled Fire Support Vehicles (WFSV), 179 Grizzly Wheeled Armoured Personnel Carriers (WAPC) and 19 Husky Wheeled Maintenance and Recovery Vehicles (WMRV). This order was subsequently increased three times during production, with a total of 491 vehicles eventually being delivered by 1982. The final count was 195 Cougars, 269 Grizzlies and 27 Huskies.

The AVGP family was never intended for use in operational roles. Its purpose was to allow Canada-based units to conduct large-scale combined-arms training at a fraction of the cost of tracked vehicles. In addition, the Cougar provided non-tank units of the Armoured Corps with a cost-effective platform on which to develop and maintain skills that would allow a rapid transition to main battle tanks when necessary. However, with Canada's significant commitments to UN peacekeeping operations around the world, the mobility and economy of operation of the wheeled AVGP quickly became apparent. This made them the vehicle of choice in Operations Other Than War (OOTW). Production of the Canadian AVGP set the Diesel Division of GM Canada on a course that would eventually see them buying the parent company MOWAG, and emerging as the world's number one supplier of wheeled light armored vehicles.

Canadian conversion to wheeled light armor

In the mid-1980s, Canadian military thinking began to embrace a total force concept with greater emphasis placed on regular and reserve force integration. Following on from the AVGP, Canada began looking for a new general-purpose vehicle with enhanced capabilities to serve as the primary armored vehicle for Reserve Forces. Additionally, the army began seeking a replacement for their M113 and Lynx tracked vehicles in 1984. However, the dissipation of the Cold War in the early 1990s, along with fiscal constraints and a desire to realize a "peace dividend", caused a great deal of debate over future roles and employment of the Canadian Armed Forces. This in turn led to the proposal and cancellation of a number of equipment programs in the 1990s, but what eventually emerged was the Bison family of 8x8 Armored Personnel Carriers (APC), Coyote 8x8 reconnaissance vehicle based on an improved LAV-25, and the all-new LAV Generation III family.

Bison

The 8x8 LAV APC (Bison) began life as a private venture by GM in 1988 when, in just seven days, engineers at the Research and Development section ("Skunk Works") designed and built the first prototype of a new multirole vehicle based on an improved LAV-25 hull and power-train components. The basic vehicle was in the form of an APC with a large power-operated rear ramp. However, all vehicles were fitted with a special rail system that allowed rapid installation of specialized mission kits to facilitate quick conversion to different roles. GM submitted the LAV APC to the Canadian Armed Forces for evaluation in 1988, and in July 1989 it received a production contract for 199 vehicles in four configurations: 149 Infantry Section Carriers (ISC), 18 Command Posts, 16 81mm Mortar Carriers (Wolf), and 16 Maintenance and Repair Vehicles (Buffalo).



This Grizzly WAPC of 3 R22eR (3rd Battalion, Royal 22e Régiment) departs its base in Bihac, Bosnia, in November 2001. The Cadillac Gage one-man turret is armed with a 12.7mm MG and 7.62mm MG. The Grizzly carries six infantrymen. (DND)



A Cougar WFSV participating in gunnery training in Wainwright in 1987. Cougars are fitted with a complete Alvis Scorpion turret with a 76mm gun and coaxial 7.62mm MG. This vehicle is unique in that a gunnery training device consisting of a tracer-firing .50-cal MG has been set up on the turret. (Jason Bobrowich)



This 6x6 vehicle is a Husky WMRV, one of 27 acquired by Canada. It was photographed during an exercise at Wainwright in 1996. A C5 GPMG is mounted, and the HIAB 650 crane is shrouded in a camouflage net. (Jason Bobrowich)



Upgraded Bisons with their trim vanes removed form up in Afghanistan in July 2003. They have received appliqué armor because of the greater threat level. A C6 7.62mm GPMG is attached to a swing mount at the commander's position. (DND)



The Cougar is normally a 6x6 vehicle - except when the suspension is torn off by a submerged boulder during river crossings! The crew did not realize what had happened until they had exited the river and the Cougar toppled forward as it drew to a stop. (Jason Bobrowich)

The Bison is a second-generation vehicle. It is slightly longer at 6.665m (versus 6.527m for the LAV-25) and heavier at 12,936kg (versus 12,792kg). It has improved suspension and braking systems, and larger Michelin XML tires. The lower hull, as well as the driver's compartment and engine area, are exactly the same as a baseline LAV-25. The engine occupies the right front of the hull while the driver is located in the left front. Immediately behind the driver is a raised cupola for the commander, with five M17 periscopes providing 180° vision across the frontal arc. The forward-looking periscope may be replaced by an AN/VVS-2 night-vision scope. The troop compartment in the rear has sides sloped at 12° as opposed to 35° for the LAV-25. Its roof is 358mm higher, giving the Bison considerably more usable internal volume.

Although initially purchased for the Reserves, the Bison soon saw service with Regular Forces on overseas deployments. The first occasion was Somalia from December 1992 until June 1993, where the Airborne Battle Group employed the Bison in three main configurations: ISC, Recovery and Mortar Carrier. Furthermore, several ISC vehicles were reconfigured for use by engineers and as ambulances. Three Bisons hit antitank mines and suffered mobility kills in Somalia, though none of the hulls were penetrated. Since 1993, Bisons have been deployed to the former Yugoslavia, Eritrea, Haiti, Kosovo and Afghanistan.

Canada is currently in the process of implementing the Equipment Rationalization Program (ERP) and the Wheeled Light Armoured Vehicle Life Extension (WLAV-LE) program. The centerpiece of these programs was the 1999 decision that all Canada's future mechanized forces would be equipped with wheeled light armored vehicles. The infantry would receive the latest version of the GDLS 8x8 APC (LAV III, unofficially referred to as the Kodiak), while the Armoured Corps would concentrate on the new Coyote. The Bison and AVGP fleets would be modernized and converted to support vehicles. In the end it was determined the AVGP 6x6 family was not capable of sustained operations with newer 8x8 vehicles, and that portion of the program was cancelled. Instead, the Bison received an upgraded power plant, newer heavy-duty suspension torsion bars, air-conditioning, and a VRS respirator Nuclear Biological Chemical (NBC) system. The number and specific types of vehicles in the converted Bison fleet are (as of 2005): 32 Ambulances, 32 Mobile Repair Team, 32 Recovery, 16 Electronic Warfare, 4 NBC Reconnaissance, 76 Command Posts and 7 Remote Rebroadcast vehicles.

The most distinctive variants of the Bison family are the Electronic Warfare (EW) vehicles known as Advanced Electronic Reconnaissance Intelligence Evaluation System (AERIES), and the Tactical Radar Identification and Location System (TRILS). Six AERIES vehicles entered service in 1995, their purpose being to operate along frontlines to intercept, identify and locate hostile VHF/UHF radio signals and to target them for countermeasures. Four TRILS vehicles entered service in 1997 to work



A Bison leaves Camp Nathan Smith in the heart of Kandahar, Afghanistan, in support of a Provincial Reconstruction Team (PRT) in May 2006. The Bison is operated by a crew of two, with accommodation for eight infantrymen in the rear. (DND)

alongside the AERIES systems. The TRILS identifies and locates various radar emitters in the battle area and targets them for countermeasures. Vehicles carry surveillance, target acquisition, counter-mortar/battery, and air-defense radar systems. TRILS is recognized within NATO as one of the best systems of its kind in the world.

Coyote

In 1993 the army placed an order with GM Canada for 229 (later reduced to 203) 8x8 day/night all-weather armored reconnaissance vehicles. At the time of its introduction in 1996, the Coyote was the only vehicle of its kind in the world, and even today the USA and UK do not possess a vehicle with the Coyote's capabilities. It was the first Canadian LAV built without an amphibious capability, though this function was later removed from the Bison and AVGP families too.

The Coyote was produced in three configurations:
1. The most recognizable version utilizes the "Brigade Surveillance Suite", where all sensors are attached to a 10m telescoping mast. A total of 32 were purchased.
2. This configuration utilizes the "Battle Group Surveillance Suite", with the same sensors mounted on two tripods that can be deployed up to 200m from the vehicle via a fiber-optic cable. A total of 152 were purchased.
3. The 19 remaining vehicles were fitted for but not with the surveillance package. These operate as Direct Fire Support Vehicles (DFSV). As part of the ERP, an additional 37 Coyotes had their sensor suites removed as a prelude to being employed in the DFSV role.

The Coyote's sensor suite consists of a Racal Man-portable Surveillance and Target Acquisition Radar (MSTAR) system capable of detecting vehicle targets at a range of 12km and human targets at 3.1km; a thermal imaging system able to identify targets 3.1km away at night or under poor visibility conditions; a visible-spectrum camera with continuous zoom capable of detecting targets out to 12km; and a laser rangefinder with a 10km range. Additional sensors include: 1. A Laser Warning Receiver (LWR) mounted on the rear of the turret top to detect incoming laser rangefinder beams, and which automatically displays the direction of the beam's origin for both the commander and driver. 2. A Ferret 3D passive acoustic small-arms fire detection system that provides bearing, range, elevation and trajectory of small-arms fire within 1km of the Coyote. 3. NBC detection and monitoring system.

In addition to surveillance equipment, the Coyote incorporates a state-of-the-art tactical navigation (TACNAV) system utilizing a digital compass and GPS with display screens for the commander and driver. Due to all its electronic equipment, the Coyote was among the first armored vehicles to be equipped with an air-conditioning system. For protection the ballistic steel hull is proof against small arms and artillery airbursts, though the vehicle is never deployed overseas without additional ceramic plates. The Coyote entered service in 1996 and has been utilized in all of Canada's operational deployments since - Bosnia, Kosovo, East Timor, Haiti and Afghanistan.

LAV III

The newest LAV in the Canadian inventory is the Gen III, which entered service in September 1996. To date, 717 vehicles in six configurations have been delivered or are on order. These include 313 ISC, 181 Command Posts, 71 Tow Under Armour (TUA), 66 Mobile Gun Systems (MGS), 47 Observation Post Vehicles (OPV) and 39 Engineering vehicles.

Having personally driven at least one example of each LAV used by the Canadian Army over the last 30 years, it is the author's opinion that 'impressive' is the only way to describe the LAV Gen III in terms of visual

impact, technology and performance. Although its lineage is apparent, the LAV III is a completely new vehicle - it is longer, wider, higher and heavier than the older LAV-25. It has an improved power pack, drive train and hydropneumatic suspension. Layout of the LAV III is similar to its predecessor, with the engine occupying the front right of the boat-shaped hull, and the driver in the left side. The winch compartment is immediately in front of the driver. The center third of the hull features the same turret as the Coyote. The troop compartment occupies the rear third of the hull, with two small air-observer hatches on either side of the roof. Unlike the LAV-25, however, the Gen III is configured as an APC with soldiers sitting on bench seats along the sidewalls. A large central rear ramp provides primary access, though a large door in its center provides secondary access.

The ISC, Command Post and Artillery OPV variants are externally similar in appearance and differ only in mission-specific details. On the other hand, the MGS, TUA and Engineering variants look considerably different. The primary systems of the Artillery OPV are a laser designator and MSTAR, the latter greatly improving the ability of Forward Observation Officers (FOO) to detect, locate and classify targets at ranges greater than were previously possible. An additional mode detects artillery shell impacts and provides automatic correction data for friendly artillery fire.

The MGS is the same Stryker-based vehicle in use with the U.S. Army. The MGS mounts a direct-fire L7 105mm cannon in a fully stabilized low-profile turret equipped with an automatic loader and eight-round ammunition carousel with a ten-round replenisher. In addition, there is a 7.62mm coaxial MG and .50-cal MG for the commander. It can fire four types of 105mm tactical ammunition, as well as a range of training rounds. Ammunition types include: High Explosive/High Explosive Plastic (HE/HEP) for use against bunkers, MG and sniper positions; Kinetic Energy (KE) for use against armored vehicles; High Explosive, Anti-Tank (HEAT) for use against soft-skinned vehicles; and canister rounds for use against dismounted infantry in the open. The commander fires the weapon utilizing a panoramic viewer integrated with the Fire Control System (FCS). The MGS entered service in 2007.

The LAV TUA features the twin-TOW armored turret designed by Kvaerner Eureka AS for the Canadian M113 TUA. Upgrades to the Norwegian Armored Launcher Turret (ALT) include an improved target acquisition and FCS that allow the utilization of all existing and future TOW missiles. So far, TOW 2A "bunker buster" and TOW 2B extended-range missiles have been test-fired from the vehicle. The TUA is currently in production and is being delivered to the field. The LAV Engineering vehicle looks similar to the U.S. Army's M1132 Stryker Engineer Support Vehicle. However, it mounts a distinctive V-shaped dozer blade/Surface Munitions Clearing Device (SCMD), a safe-lane marking system, and a hydraulic power takeoff for an auger and other tools.



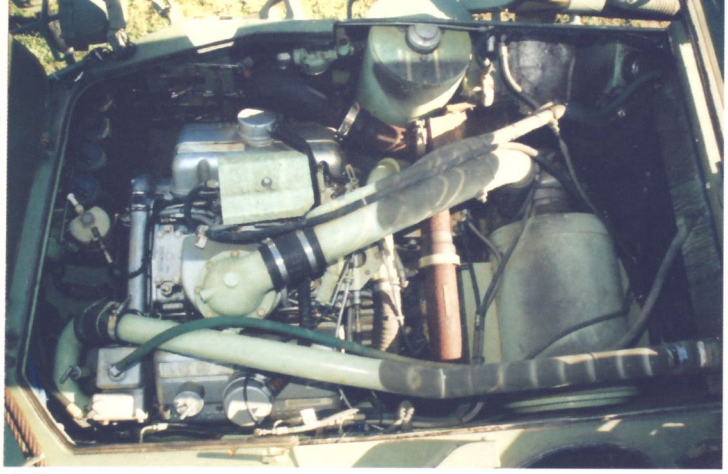
A Bison in Afghanistan. From 2002-05 the Bison received an upgraded power plant and suspension. Below the commander's cupola on the hull side behind a cover is an actuating handle for a new Halon fire suppression system. (Bjoern Clausen)



This Bison moving through Camp Julien in Kabul is in use with engineers. The Bison roof has a large (approximately 1.8m x 1.5m) outward-folding three-piece hatch towards the front, and two 61cmÇ air-observer hatches at the rear. (Sören Sünkler)



A Bison pauses during a patrol in the Afghan countryside in May 2004. A spare wheel is stowed on the nose and a generator is carried on the hull top. Note the raised wire cutter in front of the driver's hatch and the 76mm smoke grenade launchers. (DND)



A Bison engine compartment with its water-cooled Detroit Diesel 6V53T engine. This 275hp power plant is mated to an Allison five-speed MT653 transmission that propels the Bison to a top speed of 100km/h on roads.



Large red crosses identify this Bison as an Ambulance. Able to carry up to three stretcher cases, the Ambulance operates with three crewmembers (commander, driver and medic). This is a late-model vehicle, as evidenced by stowage boxes that have replaced the rear-mounted amphibious propulsion system. (Anthony Sewards)



Fitted with dozer blades, these Bison Engineer variants of the Lord Strathcona's Horse (Royal Canadian) (LdSH (RC)) are participating in workup exercises at Wainwright before deploying to Afghanistan. Observe the GPS antenna fitted immediately behind the commander's cupola. (Anthony Sewards)



Another specialist version based on the Bison is the 13-ton Maintenance and Repair vehicle referred to as the Buffalo. The HIAB 650 crane, with a traverse of 260°, can lift up to 4000kg. This makes it suitable for such tasks as changing a power pack.



A Bison Recovery vehicle stands by at an airfield in Afghanistan in late July 2003. The recently upgraded Canadian Bison fleet currently includes 32 Recovery variants. Floodlights and tow bars are standard equipment. (DND)



A Bison Recovery vehicle prepares to carry out some maintenance at Camp Julien in Kabul, Afghanistan, in July 2003. Note the stowed hydraulic outrigger above the second road wheel – these are deployed for heavy lifting tasks. (DND)



The TRILS vehicle with complex electronic equipment used for surveillance, target acquisition, counter-mortar/battery and air-defense radar systems, is one of the most distinctive variants in the Canadian Bison family. TRILS locates hostile radar emitters on the battlefield and identifies them for countermeasures.



This Advanced Electronic Reconnaissance Intelligence Evaluation System (AERIES) vehicle is based on a Bison 8x8 chassis. Observe the distinctive antenna array used to intercept, identify and locate enemy VHF and UHF radio signals.



Six AERIES vehicles entered service with the Canadian Army in 1995. They are designed to operate along the frontline in conjunction with TRILS variants.



The Coyote has no amphibious capability. It was introduced in 1996, with 203 examples eventually being delivered. This Coyote serving with SFOR in Bosnia in 2002 has a windscreen erected in front of the driver's station. The Delco Systems two-man turret features a 25mm M242 cannon and coaxial 7.62mm C6 MG. (DND)



There are three Coyote configurations – one with a telescoping mast, one with two ground-mounted sensor tripods, and one serving in the direct-fire support role. This is the Battle Group Surveillance Suite, with the 200m cable spool visible. (Dan Hay)



The Coyote shares the Bison's 275hp Detroit Diesel 6V53T power plant, but it is the surveillance system - seen here mounted on the 10m mast - that sets it apart. Four crewmen operate the Coyote.



A Coyote of the LdSH (RC) guards Kandahar Airfield in March 2002. Observe the erected mast with its MSTAR unit capable of detecting vehicles out to a range of 12km or people up to 3.1km away. The 10m mast retracts fully into the hull. (DND)



A Coyote with its mast erected. The telescoping mast boasts a thermal-imaging system, a day camera with continuous zoom, and a laser rangefinder. A C-130 Hercules aircraft can transport a single 13,400kg Coyote.



Surveillance equipment mounted on one of the two tripods carried in a Coyote Battle Group Surveillance Suite vehicle. (Dan Hay)



Coyotes with ceramic appliqué armor depart Camp Julien on an ISAF patrol. This add-on armor offers 360° protection against 14.5mm rounds and 30mm munitions across the frontal arc. (Bjoern Clausen)



"ISAF" markings indicate this LAV III is serving in Afghanistan. The LAV III is used for troop transport, with the turret armament available to support dismounted soldiers. The most common variant is the ISC pictured here. The turret features the advanced Hughes Infrared Equipment (HIRE) thermal-imaging system. (DND)



This LAV III serving in Bosnia in 2002 belongs to the 1st Battalion, Princess Patricia's Canadian Light Infantry (1 PPCLI). The vehicle is patrolling near Zgon as part of a 1450-member Canadian SFOR contingent. (DND)



An overhead view of an LAV III driver's compartment. The 16,950kg vehicle uses a 350hp Caterpillar C9 3126 diesel engine coupled to an Allison MD 3066 automatic transmission with six speeds. The LAV III possesses hydropneumatic suspension.



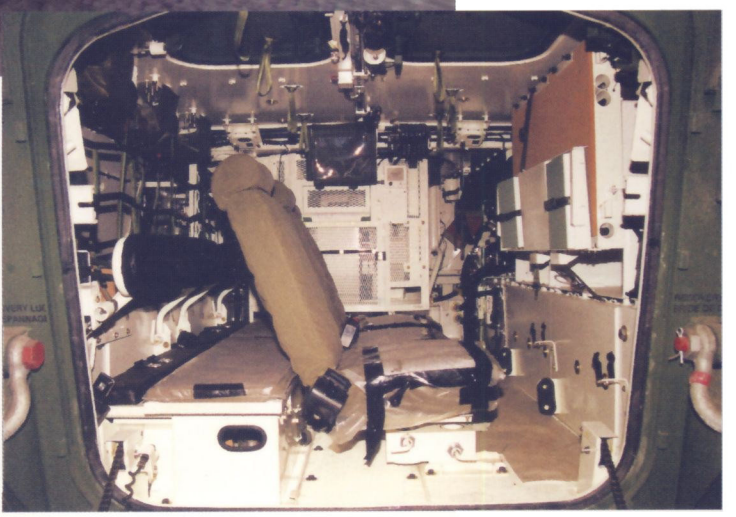


A column of LAV IIIs forms up after being unloaded from a cargo ship at Massawa in Eritrea. They were heading for Camp Groesbeek on 1 January 2001 as part of UNMEE. The 25mm M242 cannon is not yet fitted in the two-man Delco Defense Systems turrets. (DND)

An LAV III of 3 RCR in October 2003. There are six LAV III variants in service with the Canadian Army, with the TUA, MGS and Engineering vehicles being the last to join the inventory. (DND)



An LAV III on patrol in Kabul. Razor wire is stowed on the front of the vehicle, while spike strips are on the hull side for use in vehicle checkpoints. The ubiquitous 25mm M242 cannon is mounted in the turret alongside a C6 coaxial MG. (Bjoern Clausen)



The interior of a LAV III Command Post. The right-side infantry bench is replaced with a large map board, whereas the standard ISC has two bench seats positioned along the sponsons that comfortably accommodate eight troops.



A LAV III maneuvers during a Canadian exercise. The LAV III is a completely new vehicle, heavier and bigger than the second-generation LAV-25. The LAV III has a crew of three – commander, driver and gunner. (Anthony Sewards)

A dirty LAV III after maneuvers in a large reservist training exercise in 2002. Of note is the capstan winch located in the upper hull above the second wheel. Observe also the LWR mounted at the rear of the turret top. (DND)





A LAV TUA variant. Note the Kvaerner Eureka ALT containing two TOW antitank missiles. This is essentially the same armored launcher turret previously fitted on Canada's M113 TUA. (Dan Hay)

The LAV TUA launcher can fire both TOW 2A and 2B missiles. The Norwegian-designed ALT received upgrades to its target acquisition and fire control systems. (Dan Hay)



From the mid-1970s, the USMC faced an increased role in Western Europe. It began to realize the bulk of the amphibious AAV-7 was not well suited to operations beyond the beachhead. Given likely threat scenarios in Europe, there were also concerns the lack of an armored reconnaissance capability would leave Marine units vulnerable. As a result, the USMC considered acquiring a light armored vehicle to support future operations. The formation of rapid deployment forces in the late 1970s created needs in both the U.S. Army and USMC for such a general-purpose vehicle. The Marines specified the vehicle must have armor sufficient to withstand small-arms fire and shell fragments, and a weapon capable of destroying enemy APCs and reconnaissance vehicles. In addition, it had to be transportable by both the C-130 Hercules and CH-53 Sea Stallion.

In April 1981, an RfP was issued to some 20 defense contractors for the supply of such an armored vehicle to meet U.S. Army and Marine Corps requirements. By September 1981 the field had been narrowed to three competitors, including GM Canada's Diesel Division with its version of the eight-wheeled MOWAG Piranha. Following a yearlong evaluation, a production contract for 969 vehicles with an option for a further 598 was awarded in September 1982. At the same time, GM was contracted to develop and test five specialist versions of the basic vehicle: 81mm Mortar Carrier (LAV-M), Logistics (LAV-L), Command and Control (LAV-C2), Anti-Tank (LAV-AT) and Maintenance/Recovery (LAV-R).

The majority of the initial batch (680 vehicles) was earmarked for the U.S. Army where it was designated M1047. The remaining 289 vehicles were destined for the Marine Corps. Although the junior partner in the acquisition, the USMC was scheduled to receive 194 of the first 230 vehicles produced in the first two years of the contract, which would later prove fortuitous. The first production vehicle was handed over to the USMC in October 1983. However, politics intervened in early 1984 when Congress cancelled funding for army vehicles, thus placing the entire program in jeopardy. Fortunately, the Marines were able to find funding to increase their purchase to 758 vehicles, thereby keeping the program alive. By 1998 the USMC had acquired a total of 787 vehicles in eight variants. These included 422 base model LAV-25, 46 LAV-R, 94 LAV-L, 50 LAV-M, 50 LAV-C2, 96 LAV-AT, 17 Air Defense (LAV-AD) and 12 Mobile Electronic Warfare Support System (LAV-MEWSS). At the time of writing, the Marines are also in the process of fielding 22 new LAV-NBC Reconnaissance vehicles.

Organization

In the mid-1980s, the new vehicles were initially distributed in three active and one reserve LAV battalions. The 1st LAV Battalion was activated in 1985 at Camp Pendleton (California), and was assigned to the 1st Marine Division (1st MarDiv). The 2nd and 3rd LAV Battalions were activated the same year at Camp Lejuene (North Carolina) and Twentynine Palms (California), supporting the 2nd and 3rd MarDivs respectively. The 4th LAV Battalion supporting the 4th MarDiv (Reserve) was activated in 1987, with companies in California, Utah, Virginia and Maryland. Actual vehicle distribution has been somewhat fluid over the years, and at that time LAV battalions did not contain organic infantry components.

In late 1988, LAV battalions were given their own infantry component and were reorganized and renamed Light Armored Infantry Battalions (LAIB). The LAIB consisted of four line companies, each with two six-vehicle platoons. The company headquarters had two additional LAV-25s, one LAV-C2, two LAV-Ls and one LAV-R. In total, each battalion had 28 LAV-



An LAV-25 exits the water at Camp Pendleton. USMC LAVs are amphibious - two rear-mounted water propellers provide a maximum waterborne speed of 9.7km/h. However, preparations and maintenance afterwards are so onerous that crews avoid taking vehicles into the water wherever possible. (USMC)



An LAV-25 from the 3rd LAR Battalion normally based at the Marine Corps Air Ground Combat Center (MCAGCC) at Twentynine Palms. The dual-fed M242 Bushmaster cannon fires both M791 APDS-T and M792 HEI-T rounds.

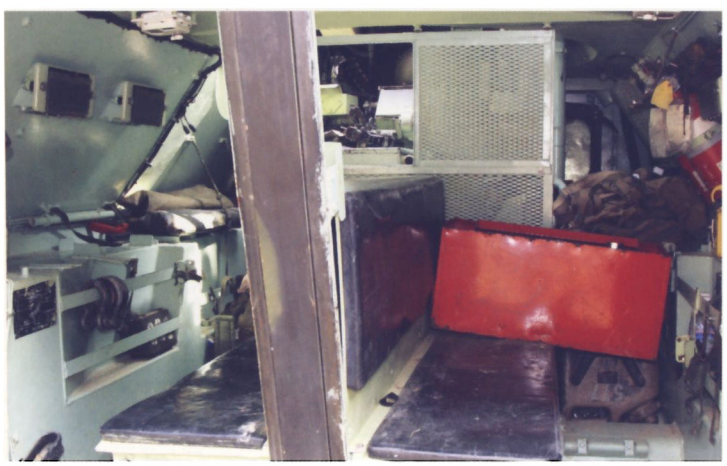
Ls, 22 LAV-ATs, 12 LAV-C2s, 16 LAV-Ms and nine LAV-Rs. Despite their name, these units were actually employed in reconnaissance and screening roles in much the same way as army cavalry units. As a result, they underwent additional name changes, first to Reconnaissance Battalion (Light Armored) in 1992, and then finally in 1994 they became Light Armored Reconnaissance (LAR) Battalions. Today, the LAV-ATs and LAV-Ms previously under battalion control have been redistributed on the basis of four LAV-ATs and two LAV-Ms to a newly created weapons platoon in each of the four line companies. Battalion HQ now consists of eight LAV-Ls, six LAV-C2s, two LAV-Rs and four LAV-NBCR vehicles.

Operation Just Cause

In keeping with the "rapid deployment" concept, Marine LAV units have demonstrated their worth over the years. Their first overseas action was Operation Just Cause, the invasion of Panama, in 1989. In May, a company from the 2nd LAV Battalion was sent to reinforce Marine Force Panama, and almost immediately the focus of operations began revolving around the armored speed and mobility of this LAV company. It conducted a number of successful "freedom-of-movement" patrols that even included swimming the Panama Canal. Due primarily to their mobility, the LAV company controlled an Area of Responsibility (AOR) of more than 650kmÇ.

Operation Desert Shield/Desert Storm

A composite battalion composed of A and C Companies from the 1st LIAB, and B and D Companies from the 3rd LIAB, were among the first units to arrive in Saudi Arabia in August 1990. Flying in from the USA, crews picked up their vehicles on arrival from Maritime Prepositioned Ships stationed at Diego Garcia. Eventually, all four LAIBs were deployed in support of the Gulf War. On the third day of the ground war, elements of the 1st LAIB were the first Coalition forces to enter Kuwait City when they captured the airport.



This view shows the rear troop compartment configuration with the turret basket immediately in front. There is space for six dismounts, but four is more common.



A 10,932kg LAV-25 reverses onto a Landing Craft Air Cushion (LCAC). The LAV-25 is 6.393m long, 2.499m wide and 2.692m high. A ground clearance of 500mm gives good cross-country mobility. Top road speed is 100km/h. All LAVs employ an Allison MT-653 DR automatic transmission with five forward and one reverse gears. (USMC)

Operation Restore Hope

In December 1992, two companies of the 3rd LAIB deployed to Somalia in support of Operation Restore Hope. Between December 1992 and April 1993, the 3rd LAIB conducted more than 400 patrols and escorted more than 4000 tons of relief supplies to outlying areas.

Operation Joint Guardian

In June 1999, elements of the 2nd LAR Battalion led U.S. forces in the NATO operation to separate Serb and ethnic Albanian forces in Kosovo. Once again, the speed, armored mobility and endurance of the LAVs proved ideally suited to patrolling the sparsely populated northern section of the Marine AOR. These patrols frequently exceeded eight hours and hundreds of kilometers in duration. These unique characteristics cast the LAVs in the role of force multiplier.

Operation Enduring Freedom, Afghanistan

The USMC acted as the vanguard of U.S. regular forces deployed to Afghanistan during Operation Enduring Freedom (OEF). It was an excellent example of 21st century Marine Corps doctrine and inter-service



This LAV-25 of the 4th LAR Battalion was seen at the Yakima Training Center in Washington in the summer of 2007. The commander is positioned in the right and the gunner in the left of the turret. Crewmen generally graduate from the role of driver to gunner to vehicle commander (VC).



LAV-25s of the 3rd LAR Battalion advance into Iraq in 2003. Elements of all four LAR battalions deployed to Iraq and their LAVs proved extremely versatile. The LAV-25 carries 210 ready rounds, and a further 210 stowed rounds for its M242 25mm chain gun. (Sgt Brandon Wright, USMC)



An LAV-25 of the 31st MEU based in Okinawa, Japan, maneuvers at a training area in Korea in March 2007. LAVs in the 3rd MarDiv possess a unique organization where AAV-7s and LAVs are combined into a single Combat Assault Battalion (CAB).

cooperation. Using C-130 and C-17 aircraft, plus CH-53 helicopters, the Marines conducted an "amphibious" assault into the middle of the Rigestan Desert, setting up a Forward Support Base at Dolangi Airfield approximately 145km southwest of Kandahar and 800km inland from the naval fleet. During this operation, elements of the 1st and 2nd LAR Battalions operating with the 15th and 26th Marine Expeditionary Units (MEU) figured prominently in all significant actions. Within days, LAV units operating 145km from their support base were interdicting al-Qaeda and Taliban movements around their final stronghold of Kandahar. On 13 December, only three weeks after landing, LAVs occupied Kandahar Airport.

Operation Iraqi Freedom (OIF)

During 2002, all four LAR battalions deployed to Kuwait in preparation for the invasion of Iraq. On 20 March 2003, LAVs from the 1st LAR Battalion were among the first vehicles to cross the Iraqi border. Later that day, LAVs from the 2nd LAR Battalion claimed the first Iraqi vehicle kills. The commander of I Marine Expeditionary Force (MEF) used two LAV-C2s as command vehicles throughout the campaign. Following the capture of Baghdad, the 1st, 2nd and 3rd LAR Battalions were formed into Task Force Tripoli and attacked north to capture Saddam Hussein's hometown of Tikrit. When OIF came to an end on 1 May 2003, stabilization operations,



An LAV-25 secures a Tigris riverbank in Al Kut on 15 April 2003 during OIF. By this stage Baghdad had already fallen, and LAVs were being used for stabilization operations. Note the bright orange VS-17 aerial recognition panel. (USMC)

security patrols and humanitarian assistance missions became the order of the day. Once again, LAR battalions demonstrated tremendous veratility, so much so that the U.S. Army accelerated the creation of its own light armored forces (Stryker brigades) and first deployed them to Iraq in October 2003.

The future

The entire fleet has undergone a Service Life Extension Program (SLEP) that upgraded vehicles to LAVA1 standard. This program was intended to ensure the LAV fleet's continued viability through till 2015, and concentrated on survivability, lethality and reliability, while at the same time reducing operational and maintenance costs. The SLEP included the following components: 1. Reliability Availability and Maintenance (RAM) program majoring on low-cost and minor vehicle and weapon enhancements focusing on safety and obsolescence issues, and support equipment and tools that increase readiness; 2. Improved thermal sight systems; 3. LAV-C2 upgrade to support a number of modern, complex digital radio configurations offering multiple secure voice and data options; 4. LAV lethality package to upgrade the M242 cannon. At the moment the M242 fires the M791 APDS-T, M792 HEI-T and M793 TP-T, but future software upgrades will allow firing of the new M919 Armor-Piercing Fin-Stabilized Discarding Sabot Depleted Uranium Tracer (APFSDS-T) round.

The future for Marine LAVs appears very bright indeed. In October 2005, GDLS was awarded a $14.6-million contract to provide Generation II suspension components for the entire LAV fleet. The USMC announced the purchase of 85 new LAVA2 vehicles. The first upgraded LAVA2 was delivered on 12 October 2007 featuring enhanced armor protection, upgraded suspension and the fitting of an Automated Fire Extinguishing System (AFES). The 25mm cannon of the LAV-25 is connected to Raytheon's Improved Thermal Sight System (ITSS) consisting of a second-generation FLIR and north-finding module. It will replace the current first-generation FLIR sight. The ITSS and components provide a distant-target location capability, along with a laser rangefinder and ballistic solution for the LAV-25 weapon system. The upgraded armor is referred to as the Ballistic Protection Upgrade Program (BPUP), and a spall liner is fitted to the interior.

The first LAVA2s were deployed to Iraq by the 2nd LAR Battalion, while the 1st LAR Battalion began training on the new vehicle in March 2008. In the light of Iraq's high-threat environment, the improved armor suite is also being progressively retrofitted to the whole LAV fleet. In a possibly confusing move, the USMC will continue to call all new vehicles LAVA1s until the entire fleet is updated with ITSS, BPUP, spall liner and 28V electric-drive turret. At that point, they will all be renamed LAVA2s, including the 85 new vehicles delivered to units direct from the factory!



An LAV-25 with a BPUP in Al Anbar province. IEDs are the number one threat in Iraq, so this vehicle is equipped with the Warlock Duke electronic warfare system produced by Syracuse Research Corporation. An M240 is affixed to a Platt swing mount at the commander's position. (Carl Schulze)



Jamming devices such as the one fitted to this LAV-25, known as Counter Radio-controlled IED Electronic Warfare (CREW) systems, intercept or block radio signals intended to detonate IEDs. (Carl Schulze)



Though fitted with a BPUP, this LAV-25 is not an A2 variant, as indicated by the lack of a wind sensor behind the turret hatch, or a GPS antenna on the left-hand grenade launcher. The Warlock Duke system is in evidence on this vehicle operating in Al Anbar province. (Carl Schulze)

The interior of an LAV-L. The Logistics variant is designed to support LAV units by carrying supplies such as ammunition, fuel and food. It can also be used as a medevac vehicle, with a special kit fitted in the left side of this vehicle for just such a purpose.





An LAV-L of the 3rd LAR Battalion in Iraq in December 2007. Note the raised roofline and large rear doors designed to ease the task of hauling supplies. Though not fitted here, a chain hoist with a 1-ton capacity can be mounted on the left rear corner to help lift cargo. (Carl Schulze)



This LAV-L with a BPUP of the 3rd LAR Battalion prepares for a patrol in Al Anbar province in late 2007. With a range of 668km, the LAV is well suited to such a mobile role. The vehicle has a crew of three – driver, loader and commander. (Carl Schulze)



A "Log" LAV of the 31st MEU at Rodriguez Range in Korea during Exercise Foal Eagle 2007. It is fitted with twin 66mm L8A1 four-barrel smoke grenade launchers. The steel tow cable is used for general towing while the other rope is ideal for jerking a vehicle free after it has bogged down.



A "C-squared" LAV (LAV-C2). Observe the array of seven antennas connected to the radio suite that commonly includes four SINCGARS radios, a UHF AN/VRC-83 radio, a HF AN/GRC-213 radio, and a UHF position reporting system. This vehicle has undergone the SLEP upgrade, as demonstrated by the modified exhaust system.



This LAV-C2 variant with a BPUP belongs to the 3rd LAR Battalion. This vehicle has a plain green finish. Radio sets are fitted along the left side of the hull. (Carl Schulze)



This LAV-C2 serving in Iraq with the 3rd LAR Battalion is fitted with a BPUP. This particular LAV variant allows a commander to direct his unit from under armor protection. (Carl Schulze)



An LAV-C2 of III MEF's CAB. The LAV-C2 shares the raised roofline of the LAV-L, but it is easily identified by its extra antennas. The vehicle has three crewmen (driver, radio operator and commander) and it accommodates three senior officers.



The two LAV-Ms in the foreground are identified by a roofline noticeably lower than that of an LAV-L. These 3rd LAR Battalion LAVs are participating in the drive north to Baghdad in March 2003 during OIF. (Sgt Brandon Wright, USMC)

LAV-Ms from Delta Company, 1st LAR Battalion, move cross-country during an exercise in 2000. The M252 81mm mortar is mounted on a rotating platform on the hull floor. A base-plate and bipod are also carried to allow dismounted use. (USMC)



An LAV-M crew of the 3rd LAR Battalion adjusts their 81mm mortar in December 2007 in Al Anbar province. The large roof hatches have been folded open for firing. This LAV-M has been upgraded for Iraqi operations by fitting a BPUP. (Carl Schulze)



This rear view of an upgraded LAV-M of the 3rd LAR Battalion operating in Iraq shows the Warlock Duke system to advantage. The new green-colored BPUP armor atop the basic sand-colored hull is evident in this picture. (Carl Schulze)





A convoy of LAVs in OIF – an LAV-25 is followed by an LAV-C2 and a couple of LAV-Ms. The LAV-M requires a crew of five (driver, commander and three mortar crewmen). A total of 94 mortar rounds are stored inside the left rear of the hull, while there are five ready rounds. (Sgt Brandon Wright, USMC)



One of the most distinctive variants of the Marine Corp's LAV family is the antitank version. This LAV-AT has erected its Emerson Electric 901A1 turret system TOW launcher during an exercise in 1997. (USMC)



This LAV-AT belonging to the Exercise Support Battalion (ESB) at the MCAGCC has its twin-missile launcher in the stowed position. A total of 14 spare TOW missiles are stowed inside the vehicle, with two ready rounds kept in the launchers. The launcher can be reloaded from under armor protection.



An LAV-AT drives aboard an LCAC during training at Camp Pendleton in 2002. The USMC acquired 96 LAV-AT vehicles. The turret launcher is the same as that fitted on the U.S. Army's M901 ITV. (USMC)



A close-up of the twin TOW "hammerhead" launcher. This design allows the vehicle to take a hull-down position and fire its launcher from a protected or hidden position. The LAV-AT was first delivered to the USMC in 1987. (USMC)



An LAV-AT advances during Exercise Crocodile in Australia in 2003. The vehicle has a crew of four (driver, gunner, loader and commander). (USMC)

The LAV-MEWSS PIP (Mobile Electronic Warfare Support System - Product Improvement Program) is not often photographed. It identifies, locates and disrupts enemy radio and radar systems. This vehicle from an unidentified unit was seen in Iraq in December 2007. (Carl Schulze)





The LAV-AD is one of the rarer versions of the LAV family, with only 17 procured. The armament consists of twin four-round Stinger anti-aircraft missile launchers and a 25mm GAU-12 triple-barreled Gatling gun (with a rate of fire of 2000 rounds per minute) that can fire while the vehicle is on the move. (USMC)



A close-up of the LAV-AD's General Electric Blazer turret. The weapon system, similar to that of the Humvee-based Avenger, has a Forward Looking Infrared (FLIR) targeting sensor and digital data link. The LAV-AD has a crew of four (driver, commander and two gunners). First deliveries took place in 1998. (USMC)



This LAV-R of the 4th LAR Battalion is on exercise at the Yakima Training Center. It can be used for maintenance (e.g. changing a power pack) with its 4086kg-capacity hydraulic crane (with 265° traverse), as well as recoveries with its 13,620kg winch.



An LAV-R of the 3rd LAR Battalion in dusty Iraq, far from the amphibious environment envisioned for it. A trim vane is erected before entering water, and the drive train is shifted to operate the twin rear-mounted propellers and four rudders. (Carl Schulze)



An LAV-R tows a disabled LAV-25 with a BPUP in Iraq in 2007. Specialist equipment carried by the LAV-R includes two welders, a 10kW generator, two MS-51320 floodlights and an extendable workbench. (Carl Schulze)



A Recovery version of the LAV in Iraq in December 2007. The hydraulic stabilizers between the second and third wheels are used during heavy lifting tasks. Rear-mounted spades can also be deployed during recovery operations. (Carl Schulze)

Australia

Australia was intent on protecting its northern border in the late 1980s, so a cavalry regiment was based in Darwin from 1992 onwards. This regiment faced wide-ranging surveillance tasks, and it required a new, wheeled reconnaissance vehicle to do the job. Consequently, the Australian Army purchased 14 LAV-25s and one LAV-R from USMC stocks in 1989, the vehicles arriving in Newcastle in 1990. Nearly two years were spent evaluating these LAVs for suitability to Australian conditions. A couple of shortcomings were the extremely hot interiors in the summer, and tires that easily punctured in rough terrain. This initial purchase was known as Phase 1 of the ASLAV (Australian LAV) project.

Phase 2 commenced in 1992 with the acquisition of 113 'Australianized' versions of Canadian-manufactured LAVs, with deliveries 1995-97 (this total included the original 14 USMC LAVs). The first Phase 2 vehicles arrived in Adelaide in February 1995. By 1997 the 2nd Cavalry Regiment, based at Robertson Barracks near Darwin, was fully equipped with 86 ASLAVs. This purchase included 33 ASLAV-25, 33 Personnel Carrier (ASLAV-PC), ten Surveillance (ASLAV-S), nine Command (ASLAV-C), two Ambulance (ASLAV-A), and ten Fitters (ASLAV-F) vehicles. A unique Australian innovation is the Mission Role Installation Kit (MRIK), which allows a range of variants to be achieved from available hull types.

ASLAVs comprise three basic hull types: Type 1 (LAV-25 with a two-man turret); Type 2 (PC, C, S and A based on the Canadian Bison hull); and Type 3, which is similar to Type 2 except the upper hull is especially reinforced for F and R variants.

ASLAV-25. Armed with a 25mm M242 chain gun and coaxial 7.62mm MAG 58 in a turret. It has a crew of three and provides the principal firepower and reconnaissance capability within cavalry regiments.

ASLAV-PC. The Personnel Carrier is usually armed with a .50-cal M2 QCB, and carries seven reconnaissance scouts as well as two crewmembers.

ASLAV-C. This Command vehicle has additional radio equipment, radio mast, map board, extra stowage compartments, erectable canvas annex, plus a special internal seating layout. Armed with a 7.62mm MG, it has a crew of four.

ASLAV-S. The Surveillance vehicle is quipped with a thermal imager, laser rangefinder and day TV camera. The various sensors are fitted to a 10m-long Will-Burt mast mounted at the rear of the hull, although they can also be dismounted for ground use. Original vehicles used the same Rasit surveillance suite fitted to the Canadian Coyote, but Project Ninox is updating 28 vehicles with a Multi-Spectrum Surveillance Suite from Thales Solutions Australia. The first deliveries occurred in 2001. The ASLAV-S requires a crew of four (commander, driver and two surveillance operators), with room for two extra personnel. It is armed with an M2 MG.

ASLAV-A. Three stretchers or six ambulatory patients can be carried in the rear compartment. It requires a crew of three (driver, commander and



A Phase 1 ASLAV-25 in action in 1994. The 2nd Cavalry Regiment's A Squadron operationally tested 14 LAV-25s and one LAV-R acquired from the USMC in 1990-91. This revealed shortcomings such as stiflingly hot interiors in the summer. (ADF)



A pair of ASLAV-25s tackles a water obstacle. All ASLAVs are amphibious, swimming via twin propellers at the rear of the hull. A steel frame, a Phase 2 ASLAV addition, protects these components in cross-country travel. Maximum water speed is 10km/h, with steering via four small rudders and the four front wheels. (ADF)

external hull and turret stowage, improved 25mm gun barrel, infantry-tank telephone and taillight clusters.

The ASLAV program entered Phase 3 when a follow-on purchase of 144 vehicles was approved in December 1997. This batch employed a greater locally produced level of content such as LAV-25 turrets made by GDLS-Australia, and vehicles benefited from improvements such as a laser rangefinder and the latest thermal imager. As a result of lessons learnt from Phase 2 vehicles, the hydraulic turret traverse system was replaced by a 28V DC electric-drive system. The turret was now quieter, faster, more energy efficient and cooler. Phase 3 vehicles began to be issued to training units early in 2003. Meanwhile, the 113 older vehicles were destined for the GDLS facility at Pooraka, South Australia, to be upgraded in a Phase 2 Standardization Phase. After their upgrade, the bulk was reissued to the 2nd/14th Light Horse Regiment (Queensland Mounted Infantry) in Brisbane, thus allowing Australia to field two armored reconnaissance units completely equipped with ASLAVs.

Phase 4 involved further enhancements to Phase 2 and 3 ASLAVs. The first 40 enhanced ASLAVs in this upgrade program were delivered in 2005, with the final vehicles rolling off the factory line on 31 October 2006. Improvements included a fully integrated and computerized FCS, an auto-lay function for the stabilized 25mm cannon that reduces to around two seconds the time from acquisition to shooting. The DTAS (Delco Target Acquisition System) thermal imager is fully integrated into the FCS, giving greater lethality whether by day or night or on the move. A fully assembled power pack has also been introduced to reduce servicing time when a vehicle suffers engine or transmission failure. All ASLAVs benefited from increased engine power and a strengthened suspension. There is also an Intra-Vehicular Navigation System (IVNS) linked to GPS, allowing commanders or crewmembers to pre-program routes and rendezvous positions.

ASLAVs have been deployed overseas operationally. The first such occasion was the UN peace support operation in East Timor in September 1999. A total of 5000 troops were deployed, including a composite squadron from the 2nd Cavalry Regiment. Most vehicles were ASLAV-PCs, with only four ASLAV-25s sent. ASLAVs served in Iraq from 2003 to mid-2008. Up to 62 ASLAVs were used for a wide variety of tasks such as convoy escort, patrols, VIP protection, troop transportation, static defense, Quick Reaction Force (QRF), and battlefield clearance. These ASLAVs made a vital contribution to Operation Catalyst, Australia's stabilization efforts in Iraq. The latest combat deployment for ASLAVs was to Afghanistan for Operation

medic) and can rapidly move forward to evacuate injured personnel. It can be fitted with a Mobile Intensive Resuscitation Facility (MIRF) when required.

ASLAV-F. This mobile repair workshop is designed for field maintenance and repairs. It carries spare parts, a 4000kg-capacity HIAB 650 crane, floodlights, and specialist tools. It is crewed by personnel from the Royal Australian Electrical and Mechanical Engineers (RAEME) – a driver, commander and tradesman.

ASLAV-R. The Recovery vehicle can salvage damaged or bogged vehicles with its 8300kg-capacity Rotzler Treibmatic winch fitted in the center of the floor in the rear. Two heavy-duty earth spades are mounted either side of the rear doors. It is crewed by the RAEME (driver, commander and tradesman), and provides a battlefield clearance capability in rough terrain. It is fitted with a 7.62mm MG.

The ASLAV is distinguished by modifications like larger and wider-profile Michelin XML tires, an Australian-made single-channel Raven Vehicle Intercom/Radio Communications System (VIRCS) with associated AB F100-HF and AB F200-VHF antenna mounts, exhaust system, propeller guards,



The ASLAV-25 can cross trenches 2m wide. Note the unique ASLAV-style exhaust muffler and front headlight brush guards. The ASLAV-25's main armament is the 25mm M242 Bushmaster cannon, with a selectable rate of fire for single shots, 100 or 200 rounds per minute. A coaxial 7.62mm MAG 58 is on its right. (ADF)

Bedecked in camouflage netting, a 13,200kg ASLAV-25 conducts a mission in the Australian outback. The Type 1 turreted version forms the backbone of Australian reconnaissance units. The agility of the ASLAV is actually one of its best defenses. Up to six infantrymen can be accommodated in the rear troop compartment. (ADF)

Slipper from 2006 onwards, where a contingent provides security for the 370-member Reconstruction Task Force in Oruzgan province. In deployed variants like the ASLAV-PC, a Kongsberg Protector Behind Armour Commander's Weapon Station (BACWS) is fitted at the commander's station. There is also enhanced steel armor plus spall liners.

New Zealand

The New Zealand (NZ) Army's two regular battalions are transitioning from a light infantry to motorized infantry force. As part of this modernization process, the LAV III was adopted as the primary combat vehicle. A contract was signed with GM Canada Ltd on 29 January 2001 for the purchase of 105 LAV IIIs. This order incorporated two distinct versions – 102 Infantry Combat Vehicles (ICV), and three Recovery (R) versions. The total cost of this project was NZ$652.833 million. The first batch of seven vehicles arrived on NZ shores on 10 August 2003, and by November 2004 the Army had taken possession of all its vehicles. The main role of the NZLAV is to provide protected mobility for light infantry maneuver groups during combat or peace support operations. When faced with a threat, the doctrinal intention is for infantrymen to dismount to conduct combat, supported by the vehicle's 25mm cannon. These vehicles are destined to remain in service for 25 years, totally replacing the last of the Army's 77 antiquated M113 APCs.

The NZLAV is a specially manufactured version of the LAV III, and it represents a huge leap forward from the NZ Army's M113s and Scorpions. It even has a number of newer features than its Canadian brother – thus some NZ soldiers refer to it as the LAV3?! The NZLAV uses the PLGR II as its GPS navigational system along with TACNAV, with displays for the commander, driver and troop compartment. The turret's laser rangefinder has a range of 9995m, and it can communicate with TACNAV by reporting grid references to aid target acquisition. When faced with high-threat environments, the NZLAV can be fitted with add-on appliqué armor capable of defeating 14.5mm ammunition. The basic armor includes a spall liner. NZLAVs are not amphibious but they are capable of fording rivers up to 1.5m deep without any



A view of the driver's position tucked to the left of the engine compartment. Above the driver's seat are three M17 periscopes, a third-generation AN/VVS 2 night-vision system and the roof hatch. On the left is the instrument display panel. (ADF)



An ASLAV-25 of the 2nd Cavalry Regiment at Robertson Barracks in August 2007. Note the sturdy 16-inch Michelin XML tires. An ASLAV-25 modification was the fitting of a spare wheel rack on the rear door - blocking one door was considered acceptable since the ASLAV-25 is considered foremost as a reconnaissance vehicle.

preparation. The three specialist Recovery versions possess a 20,000kg-capacity winch with 200m of steel cable, as well as a standard 8000kg capstan winch. The water-cooled 7.2-liter engine is a six-cylinder turbocharged Caterpillar 3126 HEUI unit. This diesel engine produces 350hp at 2600rpm.

Various Supplemental Equipment Kits were also purchased to be fitted as required. One example is the Light Obstacle Clearance Blade, of which seven were procured. There are 21 Spare Wheel Carriers that can be fitted to the rear ramp, and 73 vehicles are equipped with a hydraulic self-recovery capstan winch. Laser Warning Systems are fitted to 69 vehicles to warn of incoming laser rangefinders and target designators through a vehicle intercom alarm. Furthermore, there are 40 GID-3 Chemical Agent Detection kits that identify and warn of nerve and blister agents; these can be either vehicle-mounted or dismounted for remote operations. Air-conditioning is standard.

The NZDF proposed to deploy two motorized battalions of 51 ICVs each. This meant if one battalion was deployed operationally, the second battalion could continue training before also deploying as a replacement force. With less than 105 vehicles, any overseas deployment would be unsustainable for a period beyond 6-12 months. While the NZLAV can be carried by the RNZAF's five C-130 Hercules aircraft, there are insufficient aircraft to move a significant number of vehicles anyway. Therefore, ships remain the preferred means of transporting NZLAVs to or from NZ.

At the time of writing, 46 NZLAVs are based with the 1st Royal NZ Infantry Regiment (1 RNZIR) at Linton in the North Island. A basic motorized rifle company is organized with 16 NZLAVs, distributed on the basis of four LAVs in each of the four platoons. This means a platoon of vehicles can comfortably lift 25 infantrymen. The Queen Alexandra's Mounted Rifles (QAMR) Squadron was transferred to Burnham near Christchurch in the South Island in late 2005 and now has 19 NZLAVs. It acts as a reconnaissance unit and supports 2/1 RNZIR. Remaining vehicles are based at Waiouru with the Transitional Training Team (TTT), the entity responsible for training all crewmembers on this new piece of equipment.



A pair of ASLAV-25s from the 2nd Cavalry Regiment on patrol in northern Iraq. The regiment has three squadrons. A typical troop consists of four ASLAV-25s and an ASLAV-PC. The squadron HQ has two ASLAV-25s and two ASLAV-Cs. The echelon support element has an ASLAV-25, ASLAV-R, ASLAV-F and ASLAV-A. (ADF)

A 2nd Cavalry Regiment ASLAV-25 fitted with a complete Bar Armour System (BAS) resembling those fitted on U.S. Army Strykers. The BAS is dismountable, unlike the American version, and it forms a first line of defense against RPGs. Observe the new stowage bin on the hull side. (ADF)



An ASLAV-25 moves stealthily through bush near Darwin. All ASLAVs are finished in the standard Australian Army three-color bush camouflage scheme of green, tan and black. Either four- or eight-wheel drive can be selected.



This ASLAV-25 provides security in southern Iraq in May 2005. A short GPS aerial is visible above the right rear taillight. Adjacent behind the hinged cover is an infantry telephone. Notice how the BAS around the hull has been shed – this is a common practice to avoid vehicle accidents caused by the bulky BAS. (ADF)



An ASLAV-25 provides security in southern Afghanistan in November 2006. On the nose is the fairlead assembly for the 6,800kg dynamic-pull self-recovery hydraulic winch fitted to all ASLAVs. Vehicles are fitted with a climate control system that ensures interior temperatures do not rise higher than those outside. (ADF)

An ASLAV deployed to Afghanistan for Operation Slipper. A MAG 58 is fitted on a Platt swing mount in front of the commander's hatch. All wheels have a solid-core secondary tire next to the hub that allows the vehicle to remain mobile even with eight flat tires. All ASLAVs have an automatically-activated two-shot AFES. (ADF)





Charge of the cavalry! The 11,760kg ASLAV-PC is usually armed with a .50-cal M2 QCB at the commander's position. The markings on the hull identify this one as belonging to the 2nd Cavalry Regiment - a black inverted triangle (an insignia dating back to WWII) with the radio call sign positioned either side. (ADF)



The ASLAV's first operational deployment was a 2nd Cavalry Regiment composite squadron sent to East Timor in September 1999. The ASLAV-PC seats six soldiers facing inwards along the hull sides, with an additional seventh seat against the engine bulkhead. Note the eight Wegmann 76mm smoke grenade launchers. (ADF)



A 2nd Cavalry Regiment ASLAV-PC. The commander's cupola, with a Platt MR 700 rotating ring mount for the .50-cal M2, is located behind the driver's hatch, though it leaves the commander dangerously exposed in combat.



Most ASLAVs deployed to East Timor were PCs such as this one. Troops cannot use personal weapons from inside the vehicle, but they can stand in the large forward-hinged hatch or two smaller hatches in the troop compartment roof. (ADF)



An ASLAV-PC destined to serve with the Al Muthanna Task Group (AMTG) in Iraq. It is adorned with a BAS, plus it has a Kongsberg Protector Remote Weapon Station (RWS). This Norwegian system allows the commander to fire the weapon from under armor protection, and it has received accolades from troops. (ADF)



A close-up of the Kongsberg Protector RWS fitted with a .50-cal M2 on an ASLAV-PC in southern Iraq. The mount offers a 360° traverse and an elevation from -20° to +60°. The Kongsberg system, the same as that used on U.S. Strykers, has day and thermal sights, plus an integrated laser rangefinder.



An ASLAV-C operating with the AMTG near As Samawah in Iraq. Observe the array of antennas peculiar to the Command version. The fuel tanks carry 200 liters of diesel. The ASLAV family is powered by a turbocharged Detroit Diesel 6V53T engine producing 275hp. (ADF)



At the rear of the ASLAV-S hull is a 10m high Will-Burt mast mounting a sensor suite with a thermal imager, laser rangefinder and day TV camera. The same sensors can be dismounted for ground use on a tripod, as illustrated here. (ADF)



This ASLAV-C seen in the summer of 2007 at Robertson Barracks belongs to C Squadron of the 2nd Cavalry Regiment. Note the .50-cal M2 QCB mounted at the commander's station.



This ASLAV is fitted out with an Ambulance MRIK. The ASLAV-A is easily identified by large red crosses painted on the hull exterior. This ambulance, dressed in BAS, is negotiating mud at Camp Smitty in southern Iraq. (ADF)



Interior of an ASLAV-A. There is provision for three stretcher cases or six walking wounded patients. Australia has nine such Ambulances in its inventory. (ADF)



The ASLAV-A provides cavalry units with an armored evacuation vehicle possessing excellent mobility. "Can't Help Ya" is from C Squadron, 2nd Cavalry Regiment.



An ASLAV-F roars past eucalyptus trees. The box atop the hull contains stabilizers and stabilizer plates that connect to lugs on the rear of the vehicle for heavy lifting operations. Note the hydraulic outriggers fitted between the third and fourth wheels to provide stability when the 4000kg-capacity HIAB 650 crane is being operated. (ADF)



The BAS was developed for all three hull types in Australian service, as seen on this ASLAV-F of the 2nd Cavalry Regiment in Iraq in 2005. An opening in the hull roof allows installation of the crane, plus there are two smaller roof hatches. The ASLAV-F is well endowed with tools, oxy-acetylene kit and spare parts. (Jason Miller)



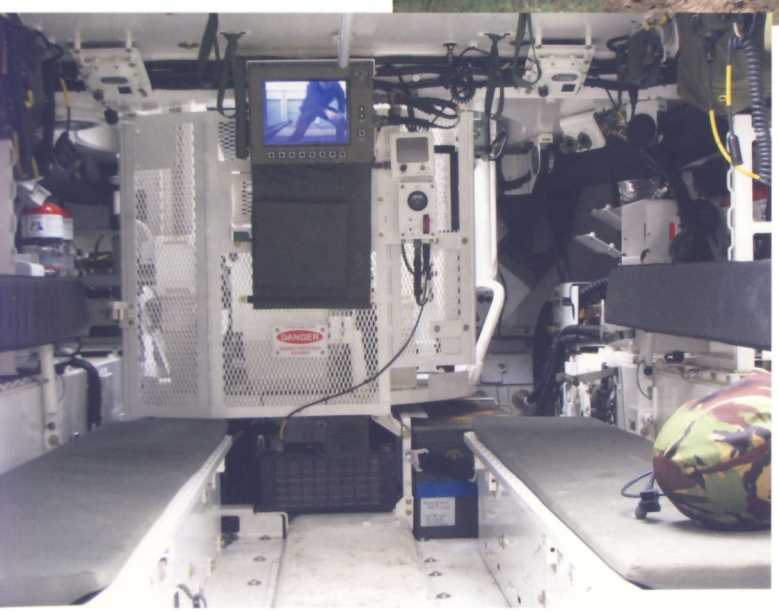
This ASLAV-R was photographed at the 2nd Cavalry Regiment compound at Robertson Barracks. It is identified as a Recovery version by the two heavy-duty earth spades mounted on the rear of the hull.



An ASLAV-R near the Iraqi city of As Samawah in July 2005. Not apparent in this view is the 8300kg-capacity Rotzler Treibmatic winch mounted in the rear compartment and its associated fairlead assembly. Upgraded ASLAVs have achieved 90+% availability rates in Iraq. (ADF)



An NZLAV emerges from a plantation at Burnham Camp. The only tactical markings are a black kiwi emblem and serial number. A 7.62mm MAG 58 is normally mounted on a Platt flexible mount on the turret roof for use by the commander. NZLAVs are painted in a standard CARC green color.



The rear troop compartment accommodates up to seven infantrymen. The roof-mounted screen is the Crew Situational Awareness Monitor (CSAM). The engine and crew compartments are equipped with a Halon 1301 AFES.



This NZLAV of W Company, 1 RNZIR, conducts training at Waiouru, the Army's premier training ground in the central North Island. Dimensionally, the vehicle is 6.98m long, 2.83m wide and 2.88m high. Mounted on the center of the hull nose is the fairlead assembly for the capstan self-recovery winch equipped with 50m of cable.

Although here concealed by camouflage netting, on the left side of the hull above the second road wheel is the compartment for a capstan self-recovery winch with a pulling capacity of 8000kg. Because it is located in this position, it can be used for recovery tasks in either a forwards or backwards direction.





Light Obstacle Clearance Blades can be mounted on any vehicle according to situational requirements, though they are allocated to engineers rather than to LAV companies. Wheeled vehicles are much better suited to NZ requirements, with greater comfort, increased serviceability and lower running costs per kilometer. (NZDF)



An NZLAV in action at Waiouru. The Kiwi LAV III uses 20-inch tires linked to a Central Tire Inflation System (CTIS) that alters tire pressure while on the move. The LAV III can be driven 40km with flat tires on one side, or if all eight tires are flat, it can continue for 8km. It can also be driven with one wheel blown off on each side.

An NZLAV of QAMR negotiates a steep incline. Just above the M242 25mm cannon is the 7.62mm coaxial MG, and further to the left is the third-generation thermal-imaging sight.



A mud-covered NZLAV maneuvers in mid-2003 during early vehicle testing. The wire cutters protecting the driver's and commander's stations are erected, and a pair of four-barreled 76mm smoke grenade launchers is evident on the turret front. NZLAVs have not yet been deployed overseas operationally. (NZDF)



The turbocharged 350hp Caterpillar 3126 HEUI engine viewed from the left. The NZLAV has a maximum governed road speed of 109km/h, and its 200-liter fuel tanks offer a range of 450km. The vehicle has power steering, plus ABS on three axles.



This NZLAV awaits a "replen" (replenishment) after a battle drill. All eight wheels have independent hydropneumatic suspension with a height control system that lowers the vehicle by 23cm - useful for transportation by C-130 Hercules. The vehicle returns to its normal height within 30 seconds while on the move.



The protrusion at the rear of the turret on the vehicle on the left (just above the chevron) is an LWR. The NZLAV has a tare weight of 14,791kg, but this can rise to 20,594kg when loaded up for combat and with an obstacle blade fitted.



An NZLAV during live-firing at Waiouru in the winter of 2006. The turret contains the tried-and-tested M242 25mm chain gun. It is linked to a Thermal Image Intensification Sight allowing stabilized day and night shooting at targets 2000+m away with HEI-T or APFSDS-T ammunition from a dual-feed system.

Belgium

The Belgian government announced on 27 January 2006 it was purchasing 242 Piranha IIIC 8x8 vehicles in a ?500-million contract as part of its Armored Infantry Vehicle (AIV) program. This constituted MOWAG's single largest order from a European NATO member. A range of vehicle types and armaments will be procured, including the CMI 90mm turret, Elbit 30mm Overhead Weapon Station (OWS) and FN Herstal Arrows 12.7mm OWS, all in combination with OIP electro-optical aiming systems. Other equipment to be fitted is the Thales Belgian Communication System, Threat Detection Systems for Lasers and Small Arms, and the Pearson Surface Mine Plow and Dozer Blade. One of the reasons the Piranha was chosen was its high commonality with fellow NATO fleets. Vehicles will be delivered in seven variants – APC, C30, Direct Fire Capability, Command Post, Engineering, Ambulance and Recovery. The first batch of 138 vehicles will be delivered 2007-2012, while a second batch will be fielded 2012-2015 (plus there is an option on a third batch). Initial vehicles and all driveline and suspension components are to be manufactured at MOWAG's Kreuzlingen facility, with hull and vehicle assembly taking place at Jonckheere and CMI in Belgium.

Denmark

The Danish Army Materiel Command signed a contract on 29 December 1997 to procure 22 Piranha 8x8 IIIHs to replace aging trucks. This purchase consisted of 18 APCs, two Command Posts and two Armored Recovery Vehicles (ARV). The first vehicles were delivered on 28 May 1999, most of them manufactured by Falck-Schmidt in Odense, Denmark. Danish Piranhas IIIHs are powered by a German MTU 6V183 TE22 engine, and are fitted with a Krauss-Maffei Wegmann 1530 turret housing a .50-cal M2 with a day/night sight, and a battery of six 66mm smoke grenade launchers. The weapon station's optical aiming device allows it to hit targets out to a range of 1200m. None of Denmark's Piranhas are amphibious. A further 22 vehicles were ordered in June 2003, of which half were APCs and half Ambulances.

Denmark later enlarged its fleet of Piranhas with a third order for 69 Piranha IIIC vehicles on 5 October 2004. These vehicles were selected for their suitability for overseas peace missions because of good ballistic and mine protection. The principal differences between IIIH and IIIC models are the engine and suspension, with the newer IIIC using a 400hp six-cylinder Caterpillar C9 Euro III engine, while each wheel has independent suspension with coil springs at the front and torsion bars at the rear. The latest IIIC batch included the following variants: five Ambulances (delivered April-July 2005), 42 APCs (delivered April 2006-February 2007), six Command Posts (delivered September-November 2006), and 16 Reconnaissance vehicles (delivered March-July 2007). The first variant delivered in this third order was the Ambulance to allow its deployment to Iraq to serve alongside other Piranhas operating there since 2003. MOWAG Piranhas are operated by the Jutland Dragoons and the Royal Guards. The latter unit has four companies of Piranhas in its mechanized battalion, with each company containing three combat platoons of three vehicles each. From February 2001 onwards, 11 vehicles saw operational deployment in Kosovo.

Ireland

Competing against the Steyr Pandur, MOWAG won a contract to supply the Irish Defence Force (IDF) with a new APC to replace the elderly Panhard M-3. Ireland signed a €50.8-million contract for 40 Piranha IIIH 8x8 vehicles in November 1999. The initial batch included 34 APCs, four Command Posts, one Maintenance and Recovery vehicle (basically a Fitters vehicle) and one Ambulance. B Company of the 3rd Infantry Battalion was the first unit to receive the Piranha in June 2001 after they were fitted out with radios and other equipment at the Curragh Cavalry Barracks.

In early December 2002, the Irish Minister of Defence signed a contract for the purchase of 25 additional Piranha IIIH 8x8 vehicles at a cost of €33.2 million (due to budget cutbacks, the IDF revised its order down from 40

An 18,500kg Danish Piranha IIIH Command Post belonging to the CO of the Royal Guards' 4th Motorized Armored Infantry Company in Kosovo in February 2001. The 400hp 10.06-liter MTU turbocharged diesel engine is coupled to a ZF Ecomat 7HP 600 automatic transmission with seven forward and one reverse gears. (Per Aebeloe)





A Danish Piranha IIIH APC parked at Camp Olaf Rye in Kosovo in 2001. Note the razor wire on the front to prevent people climbing onto the hull, while wire cages protect the headlights and gunner's position from stone throwers. (Martin Pagh)



Capable of a top speed of 105km/h, a Piranha IIIH maneuvers in Denmark. The two-color camouflage scheme of green and black is known as SK 80. The weapon station is the German-manufactured Krauss-Maffei Wegmann 1530 featuring a .50-cal M2 HB. The standard APC version carries ten soldiers. (Danish Army)

vehicles). This second batch consisted of 20 APCs, four Command Posts and one Ambulance, with the first vehicles arriving in March 2004. The first couple of Piranhas delivered to Curragh suffered from hairline cracks in the steel armor plates. This caused an immediate suspension in deliveries, though the manufacturer quickly rectified faults. The Irish Piranha IIIH is fitted with a Thales FVT800 turret mounting a .50-cal M2 QCB and coaxial 7.62mm FN GPMG. The weapons are aimed with an Avimo day/night sight with E-DGNS eye-safe laser rangefinder. There are also eight 66mm smoke grenade launchers. The Irish Piranha IIIH is powered by a 400hp turbocharged six-cylinder MTU 6V183 diesel engine. The transmission is a ZF Ecomat 7HP600 automatic unit with seven forward and one reverse speeds.

The third and latest IDF purchase revolved around a €36.5-million contract to buy 15 further Piranhas. This contract was signed on 20 December 2005, bringing Ireland's Piranha fleet to 80. These latest acquisitions are set to operate in the reconnaissance role and will be issued to cavalry squadrons to provide commanders with Reconnaissance, Intelligence, Surveillance and Target Acquisition (RISTA) capabilities. Of this order, nine will be equipped with the Norwegian Kongsberg RWS mounting a stabilized .50-cal M2 in a version known as a Close Reconnaissance Vehicle (CRV). The six remaining vehicles feature an Italian-made Oto Melara turret armed with a 30mm Bushmaster II automatic cannon (with +60°/-10° elevation) and coaxial 7.62mm FN MG. This Medium Reconnaissance Vehicle (MRV) has a two-man power-operated turret utilizing a Hitfist FCS with a laser rangefinder and thermal night-vision camera. An additional 7.62mm MG is pintle-mounted on the turret. Deliveries of this batch began in February 2007. There are also rumors a turreted Piranha with a 105mm gun may follow at some stage in the future.

The Irish Piranha has been deployed operationally, with six vehicles serving in Eritrea with UNMEE as part of a 200-strong Irish force. These deployed on 5 December 2001 and returned home in mid-2003. Other vehicles have been deployed to Kosovo from October 2003 onwards as part of KFOR. More recently, a mounted company with 22 Piranha APCs deployed to Liberia in November 2003 as part of the UN Mission in Liberia (UNMIL). The latest deployment of Piranhas occurred on 31 October 2006 when the 34th Infantry Group departed to serve with the UN Interim Force in Lebanon (UNIFIL). The detachment of 158 troops included 12 Piranha IIIH vehicles to provide security and reconnaissance for 250 Finnish Army engineers.

Romania

Romania selected the Piranha IIIC in December 2006 to meet an urgent operational requirement for deployments to Afghanistan and Iraq. An order for 31 vehicles was placed in May 2007, with the vehicles destined to feature an unmanned turret manufactured by Elbit Systems of Israel. These turrets are armed with a 12.7mm MG. These vehicles were due for delivery in 2008.



The Piranha III is often referred to as "The Fish" by Danish troops. "PFOR" represents "Poland Force" during Exercise Strong Resolve 2002. The hull sides feature attachment points for add-on armor jointly developed by MOWAG and Falck-Schmidt. (Borge Moller)

Spain

Spain signed a €45.4-million contract in 2001 for 18 Piranha IIIC 8x8 vehicles. These were delivered in two batches, the first at the end of 2003 and the second in March 2004. They equipped two mechanized companies of the Brigada de Infanteria de Marina (BRIMAR, or Spanish Marines), giving a new dimension to the Marines' amphibious-assault capability and peacekeeping operations. The key feature of these vehicles is the Cadillac Gage-Textron turret mounting a .50-cal M2 and Mk.19 40mm automatic grenade launcher (AGL), just like the Up-Gunned Weapon Station (UGWS) found on USMC AAV-7A1s. The initial purchase included the following variants:

1. One Battalion Command Post variant - it has no turret but is fitted with a Krauss-Maffei Wegmann weapon station mounting a .50-cal MG. Special features include PR4-G communications equipment, an Auxiliary Power Unit (APU), and extendable tent annex.
2. One Company Command Post variant - it is fitted with a Cadillac Gage-Textron turret armed with an M2 MG and Mk.19 Mod.3 40mm AGL.
3. Three Section Command Post variants - externally identical to the Company Command Post, but with different radio equipment.
4. 12 APC variants with the same Cadillac Gage-Textron turret.
5. One Ambulance fitted with four stretchers and associated medical equipment.

A 400hp Caterpillar C9 diesel engine drives twin propellers at the rear for amphibious propulsion in water. A trim vane and protected gas-escape



Denmark was swift to contribute troops to Iraq after the 2003 invasion. The second rotation of the Danish Contingent arrived on 12 October with Piranha IIIHs painted in a sand color and with an appliqué armor kit. It is air-conditioned for greater comfort and operates with a crew of three (driver, gunner and commander). (Danish Army)

system are also part of the amphibious kit. CTIS aids in travel over soft ground, plus the vehicle is transportable by C-130 Hercules. For NBC protection, the vehicle has an overpressure system. Spanish Piranhas are fitted with an Avimo-Thales Optronics LWD2 laser warning system, with four sensors mounted each side of the turret roof. It detects any hostile laser-targeting device, and warns the crew via visual and audible signals. Vehicles possess an Ultrak video monitoring system on the upper rear hull that provides a view of the vehicle's perimeter. This video picture is displayed in the troop compartment, and is useful for peacekeeping missions.

The initial contract provided for options on 38 Piranhas staged over three phases. On 20 December 2007, a contract for 21 additional amphibious vehicles was signed, these due for delivery in 2009-14. This latest contract comprises nine variants including APC, Fire Capability, Command Post, Engineering, Ambulance, Recovery and Reconnaissance. The new Piranha IIIs serve in the BRIMAR's two mechanized infantry companies, each organized into two sections possessing four Piranhas each.

Sweden

The Swedish Defence Material Administration (FMV) signed a contract in the autumn of 1996 for several Piranha IIIC 10x10 Armored Command Vehicles (ACV) for the Swedish Navy's *Kustartilleriet* (Coastal Artillery). Two Lirka ACVs were delivered in 1997, with five more following in 1998-99. The 14m³ internal volume of the 10x10 ACV is filled with sophisticated electronic C3I equipment. However, the vehicles' role is now unclear after restructuring of the Swedish Armed Forces. Presently they are being used in association with the "ArtDemo" (Artillery Demonstration) project involving the new Bofors Archer 6x6 artillery truck. A 40kW APU supplies electrical power to the ACV, while a small dozer blade can be fitted under the bow. The power pack is a Scania DSJ9-48A diesel unit developing 387hp.



This Danish Piranha was photographed in November 2004 at Camp Daneverg near Basra in Iraq. With a 300-liter fuel tank, the vehicle's range is 600km. The body can be raised 23cm thanks to its hydropneumatic suspension, which aids travel in difficult terrain such as mud. (Danish Army)



The interior of a Piranha IIIH Command Post. Fitted on the right is a table and map board, with HF and VHF radios plus a satellite phone located behind it. In Kosovo this vehicle was usually crewed by a CO, gunner, two signalmen and an EW soldier. Being independently sprung, individual seats offer superior comfort. (Per Aebeloe)



One of Denmark's 16 new Piranha IIIC models delivered April-July 2005. The IIIC has a 400hp six-cylinder Caterpillar C9 Euro III diesel engine. This Ambulance variant was introduced as a replacement for the SISU XA-185, with some immediately deploying to Iraq. (Martin Pagh)

In 1996, the FMV contracted MOWAG to produce a prototype Armored Sensor Vehicle (ASV) based on the 10x10 ACV. The resulting vehicle was particularly complex, and included a foldable, hydraulically-operated mast system. The mast has two extendable working positions at either 10m or 15m. Development of this prototype was followed by the signing of a contract with MOWAG on 24 August 2000 for the supply of five further series-production Piranha IIIC 10x10 ASVs to serve in the *Kustartilleriet*. These Kapris ASVs were manufactured in Switzerland and were all delivered by 2002. Vehicles possess an automated self-leveling system, and the whole package is designed to operate in Sweden's harsh winters. It uses the latest-generation Ericsson Microwave Systems Giraffe coastal-defense radar. Vehicles possess an 8-ton winch in the front left of the hull, and an NBC overpressure system that filters 170m^3 of air per minute.

In addition, the Swedish Air Force identified a need for a mobile protection force for its forest landing strips. To this end it tested a MOWAG 8x8 Piranha II acquired in 2002. However, when Sweden all but abandoned its forest landing-strip program, the Piranha was no longer needed and so was trialed for alternative duties. The solitary 8x8 trial vehicle is fitted with a Bofors Lemur RWS fitted with a .50-cal MG. The Lemur RWS is gyro-stabilized, armor protected and has electro-optical sights.

Switzerland

Until the 1990s, Switzerland maintained a largely static territorial army of 600,000 personnel, with no armored vehicles available to the infantry. The Army 95 and Army XXI policies enabled the Swiss Army to downsize, modernize and achieve greater mobility, with the locally manufactured MOWAG Piranha playing an important role in this transition. The Swiss Army is a loyal MOWAG customer, with more than 850 Piranhas in a multitude of configurations currently in service.

One of the first variants in the extensive Swiss Piranha fleet was the 6x6 Panzerjäger (Tank Hunter) mounting twin TOW missiles in the Norwegian-designed Kvaerner-Eureka ALT. More than 300 of these 6x6 Piranha I vehicles (also known as Pzj 90) entered Swiss service in the early 1990s, though they are now obsolete. Based on a 20 December 2005 contract with MOWAG, 40 surplus 6x6 Piranha Pzj 90s were converted into armored ambulances (Sanitätsfahrzeug), with deliveries commencing in late 2006. These high-mobility ambulances will replace part of the Pinzgauer 6x6 ambulance fleet due for withdrawal by the end of 2008. The new Piranha Ambulance carries three stretcher cases or six seated patients, and up to four crewmen. In a further contract signed on 21 December 2006, MOWAG will convert 160 Panzerjägers into protected Command vehicles. These will feature the Swiss Army's new Communication and Battle Management System (FIS HE), and are due for delivery in 2008-10. A Kongsberg RWS will also be fitted. These refurbished Ambulances and Command vehicles will remain in service for a further 25 years.



Stuck in the mud! The crew of a Piranha IIIH awaits recovery. The CTIS has four pre-selected tire pressure levels (road, terrain, sand and emergency) automatically controlled every 30 seconds, though obviously to no avail in this case! (Danish Army)



The IDF has two Piranha Ambulances crewed by a driver, commander, and medic. They have no turret, and red cross markings are emblazoned on the hull. Ground clearance is 595mm – a hydropneumatic suspension system automatically adjusts for load and temperature to ensure a constant ground clearance. (IDF Press Office)



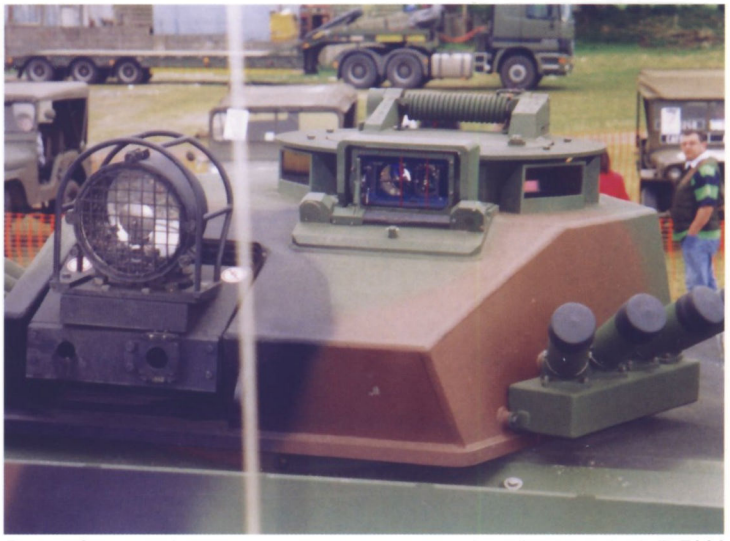
This Piranha IIIH APC powered by a turbocharged 400hp MTU 6V183 engine was seen on an exercise of Ireland's 93rd UN Overseas Battalion. This view shows to advantage the Thales FVT800 turret with its twin MG armament. Maximum combat weight is 18,500kg. A spall liner is fitted. (IDF Press Office)

The Swiss Army's most common variant is the 8x8 Piranha II, and by the end of 2002 it had received 520 vehicles. It is fielded in three configurations:

1. Füsilier-Radschützenpanzer 93 (Rad Spz 93) - 347 of these standard APC versions are fielded by combat units, with an additional 11 used for training.
2. Panzerabwehrlenkwaffenpanzer (PAL Pz93) - this version has the right-hand side bench seat removed to allow stowage of eight Dragon antitank missiles. Externally, it is identical to the Rad Spz 93 version. The Army has 60 of these.
3. Kommandopanzer (Kdo Pz93) – 102 Kdo Pz93 Command vehicles were purchased in an upgraded version known as the Kdo Pz93/99 and Kdo Pz93/99 INTAFF (Integriertes Artillerie Führungs-und Feuerleitsystem) for the artillery.



Ireland has 54 Piranha IIIH APC versions like this one. A crew of two operates the vehicle, while nine infantrymen are transported in the rear. This 3rd Infantry Battalion vehicle was photographed in Curragh in late 2004. Note the brackets on the top corners of the hull for inserting camouflage net poles. (Paul McMahon)



The MGs (not fitted) in the one-man electrically-operated FVT800 turret are supplied with 100 ready and 300 stowed rounds for the M2, and 250 ready and 1000 stowed 7.62mm rounds. The coaxial spotlight has an output of 700,000 candelas. Two 66mm FVG-66 smoke grenade launchers are on the turret. (Paul McMahon)

Unfortunately the two-stroke Detroit Diesel engine of the Piranha I and II did not conform to Switzerland's latest emission laws, so future orders centered on the newer Piranha IIIC. The first order for 12 Piranha III Command Post variants was placed in May 2000. The Swiss Defence Procurement Agency later signed a contract in mid-December 2002 to procure 36 state-of-the-art Radio Access Point vehicles (RAP Pz). With electronic equipment produced by Thales Communications, these Piranha 8x8 IIIC vehicles use the SE-235 radio system to provide secure communications between the Swiss tactical radio network and military telephone system over long distances. Delivery from MOWAG's Swiss production facility began in mid-2004 at the rate of three vehicles per month. For self-defense each vehicle is provided with a weapon station mounting a 12.7mm MG64. A 30kVA 400/230V APU supplies electrical power to the CNRI and air-conditioning system.

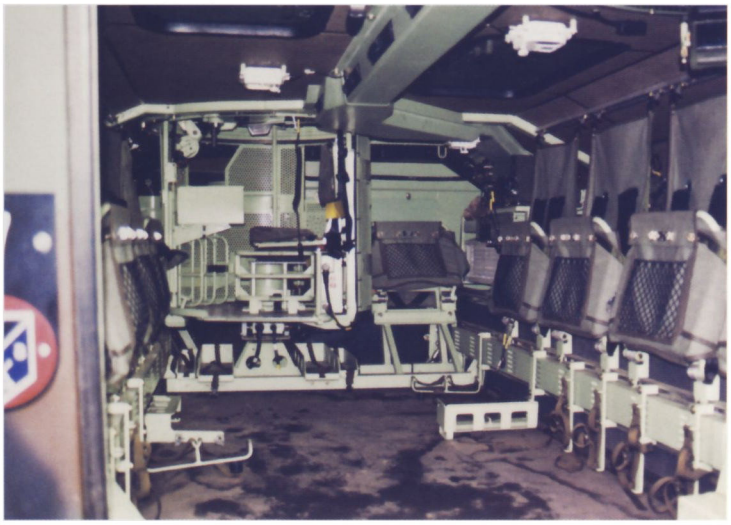
An order was placed in late December 2005 for eight Piranha IIIC 8x8 Integrated Radio Surveillance and Transmitter System (IFASS) vehicles, due for delivery by the end of 2007. These EW vehicles can locate, intercept and jam hostile wireless communications. In November 2007 a further order was placed for a batch of 26 Piranha IIICs due for delivery in 2010-11. Of this order, six are Armored Command Vehicles for the Swiss Army's FIS HE battlefield management system, eight are Armored Communications Vehicles, and the remaining 12 are RAP Pz.



The sole Irish Piranha IIIH Maintenance vehicle is operated by three crewmen. It has an 8000kg-capacity capstan winch with 90m of cable. Other ancillary equipment includes a 110/220V generator, compressor, electric arc welder, oxy-acetylene welder, two air-operated jacks, 50cm chainsaw and a tent annex. (MOWAG)



A column of Irish Piranha IIIH vehicles in Kosovo. The photo illustrates how the Thales turret is offset to the left of the hull centerline. The standard Irish camouflage scheme is bronze green, black and leather brown in an approximate ratio of 70:20:10. The ballistic hull can withstand 8kg mine blasts. (IDF Press Office)



Evident in this interior shot of an Irish Piranha IIIH APC is the 1m-diameter basket of the one-man Thales FVT800 turret. The troop seats fold up when not in use. The air-conditioned troop compartment is fitted with an arctic heater kit rated to operate in temperatures down to -40°C. There is also an NBC protection kit. (Patrick Foley)



This Irish Piranha IIIH Ambulance was photographed outside the RAP at Camp Clara in Monrovia, Liberia, in August 2004. The Ambulance is able to carry four stretcher cases, or two stretcher cases and four walking wounded patients. (Mats Hjorter)



Piranha IIIH APCs conduct a patrol in Liberia in 2005. Irish Piranhas are used in the light infantry role to deliver soldiers safely to the frontline, and then provide support with the turret's twin MGs. All vehicles have CTIS, and the Michelin 12.00R20XL tires can travel 50km even if flat. (Mats Hjorter)



A Piranha, its side stained black by exhaust, serving with the UN in Sierra Leone. All Piranhas serving overseas are fitted with STBMS (SINCGAR Tactical Battle Management System) developed by Geosolutions Ireland. It combines GPS, vehicle positioning map overlays, SINCGAR, and Marconi personal radios. (Mats Hjorter)



The Cadillac Gage-Textron turret of BRIMAR Piranha IIIC APCs is identical to the UGWS fitted to the USMC AAV-7A1. In water, the six-cylinder Caterpillar C9 3126 engine propels the Piranha to a maximum speed of 9.3km/h. It has an endurance of four hours in water, or a range of 480km on roads. (Juan Pablo Lasterra)



This is Spain's sole Piranha IIIC Battalion Command Post vehicle, identifiable by a profusion of radio antennas. It is fitted with a Krauss-Maffei Wegmann weapon station mounting a .50-cal M2 HB and four two-barrel M246 66mm smoke grenade launchers. Note the APU mounted on the roof. (MOWAG)

One of the Spanish Marines' Piranha IIIC APCs maneuvers at Campo de Adiestramiento de la Sierra del Retín. Vehicles carry eight Marines (two squads of four riflemen) plus three crewmen. The vehicle has a maximum payload of six tons, bringing its combat weight to 18.5 tons. (Juan Pablo Lasterra)





One of six ASVs of the Swedish Kustartilerriet. *The 10x10 Kapris is based on a stretched Piranha IIIC chassis. Here the outriggers of the automated self-leveling system have been extended in anticipation of the hydraulic mast being unfolded. None of the wheels touch the ground when the sensors are in operation. All six 19-ton vehicles had entered service by 2002, each crewed by six personnel. (MOWAG)*



This is the Lirka ACV, a 10x10 Piranha IIIC. The vehicle weighs 13 tons unladen and is 7.91m long, 2.6m wide and 2.91m high. Seats are provided for eight passengers. The ZF ECOMAT 7HP600 automatic transmission provides seven forward and one reverse speeds. The distinctive three-color camouflage pattern is perfectly adapted to Sweden's forests. (Swedish Armour Historical Society)



An ASV with the radar mast fully erected to the 15m-high position, an operation that takes three minutes. A 40kW APU powers the vital multi-function Agile Multi Beam ArtE 740 radar and communications systems. Overall dimensions of the vehicle are 9.6m long, 2.6m wide and 3.8m high. (Swedish Armour Historical Society)



Sweden's solitary MOWAG Piranha II 8x8 is visually identical to vehicles in service with the Swiss Army, except for a .50-cal MG mounted on a Bofors Lemur RWS. A dog cage is inside the troop compartment, as airfield security guards often make use of dogs for patrols. (Swedish Armour Historical Society)



The 11-ton 6x6 Piranha I "tank hunter" was introduced into Swiss Army service in 1990, so it is referred to as the Panzerjäger 90 (Pzj 90). The main armament is a Kvaerner-Eureka ALT mounting a pair of TOW 2 missiles. Eight missiles are carried internally and the vehicle operates with five crewmen. (MOWAG)



The Piranha I Ambulance involved a major conversion of 40 surplus 6x6 Pzj 90 vehicles. This is the Swiss Army's first armored ambulance, and they can carry three stretcher cases or six seated patients. Standard onboard medical equipment includes respirators and oxygen, while the interior is fully air-conditioned. (Swiss Army)



Three versions of the 8x8 Piranha II entered service in 1993. All possessed the same RLS 606-A1 CH one-man turret, with a .50-cal MG and eight integrated 76mm Nebelwerfer 87 smoke grenade launchers. The vehicle on the left is a Kdo Pz93 Command version from the 13th Infantry Battalion. (Swiss Army)



Swiss vehicles have a slightly longer hull than standard Piranha IIs. Note the distinctive stowage boxes and external fuel tanks fitted on both hull sides. Swiss vehicles are powered by a six-cylinder Detroit Diesel 6V53T engine. Owing to engine emission limits, subsequent acquisitions are Piranha III based. (Pierre Delattre)



The RLS 606-A1 CH turret of the Piranha II is fitted with a 12.7mm MG64/93, a Swiss version of the .50-cal M2. The most numerous Piranha II variant is the standard Rad Spz 93 APC pictured here in a three-color Swiss camouflage scheme. (MOWAG)



Swiss mechanized infantrymen dismount from their Rad Spz 93. The vehicle carries two crewmen (commander and driver) and up to ten infantrymen. It has a top speed of 100km/h and a range of 400km. An appliqué armor system increases protection against 14.5mm AP munitions over the vehicle's frontal arc. (MOWAG)



A Piranha II Rad Spz 93 with an APU fitted at the rear of the hull on the left side. The Piranha II's dimensions are 6.98m long, 2.63m wide and 2.88m high. It can wade through water up to 1.3m deep without preparation. The MG64/93 was developed from the standard MG64 in 1993 for fitting to the Rad Spz 93. (Pierre Delattre)



This prototype EW vehicle is based on a Piranha IIIC hull. Eight such IFASS vehicles were ordered for delivery by late 2007. Its array of antennas and sophisticated electronic equipment enable the interception and disruption of enemy radio communications. (Swiss Army)



Switzerland placed an order in 2002 for 36 RAP Pz vehicles based on the Piranha IIIC. Its SE-235 radio system acts as a 'cellular phone antenna' to bridge military radio and telephone networks. Here the vehicle's 10m-long telescoping mast is in the transport position. An MG64 is on an RLS 609-CH RWS on the front hull. (MOWAG)



Another view of an RAP Pz, in this case with the telescoping mast fully extended through a totally automated process. The RAP Pz is vital for improving the command and control of tactical units. It is 8.15m long, 2.77m wide and 3.5m high.

Brazil

Brazil joined the MOWAG Piranha family on 6 September 2006 when the Brazilian Navy signed a contract for five Piranha IIIC 8x8 vehicles (four APC versions and one Maintenance vehicle) to equip its Marines. These amphibious vehicles were due to serve in the UN Haiti mission in 2007. This was the first sales success for the Piranha III in South America, and followed trials with the Piranha III in 2000. This initial order was followed by another on 17 December 2007 for five additional vehicles in the same configurations.

Chile

Also in South America, Chile produced the Piranha I 4x4 and 6x6 under license by Industrias Cardeon SA. The 6x6 version was similar to the Canadian version, and a total of approximately 150 6x6 vehicles were delivered. Licensed production was later transferred to FAMAE (Fabricationes Militaires), which commenced production of the 8x8 Piranha I version in 1993. A total of 22 were produced and they were fitted with a cupola armed with a 12.7mm MG. They had no amphibious capability.

Nigeria

Nigeria bought 140 vehicles divided into two equally sized batches. The first was delivered in 1982-83 while the second was completed in 1988. The most common weapon system was a MOWAG Type V 041 turret featuring a .50-cal M2 and 7.62mm MAG 58.

Miscellaneous African Countries

Several African nations acquired 6x6 Piranhas, though details about some of these purchases remain sketchy. African countries known to have procured the Piranha I are Ghana, Liberia and Sierra Leone. Ghana procured 60 vehicles (a total of 30 6x6 and 30 8x8 Piranha I) in 1980. A further three 8x8 Piranha II vehicles were delivered in 1999.

Oman

In 1994 the Royal Army of Oman placed an order for 80 Piranha II 8x8 vehicles to equip the Army's 1st Battalion. They were built under license by Alvis Vehicles Ltd of the UK. The order included six variants (including an APC armed with a 12.7mm MG, 81mm Mortar Carrier, Command, Ambulance, and Artillery Observation). Oman subsequently signed up for 80 further Desert Piranha II 8x8 vehicles on 7 November 2000. This order was made up of seven variants (the previous six, plus a Repair and Recovery vehicle) that were all delivered by the end of 2002. Some vehicles received locally designed and manufactured turrets. None of these Desert Piranhas manufactured by Alvis had amphibious capabilities.

Qatar

Alvis Vehicles Ltd also manufactured Desert Piranha II 8x8 vehicles for Qatar. In a contract signed in 1996, 36 Fire Support Vehicles were ordered. These vehicles mounted a 90mm Mecar gun in a turret. In 1996, a further order for four Command vehicles was placed, these being delivered in 1998. One of the Qatar variants was an advanced NBC Reconnaissance Vehicle fitted with an integrated NBC detection system, and a Block II Chemical and Biological Detector.

Saudi Arabia

In 1991 an agreement was signed between the Saudi Arabian Ministry of Defence and Aviation (MODA), MOWAG and GKN Defence (the licensed system prime contractor). This contract provided for the latter to manufacture 499 LAV/Piranha II 8x8 vehicles at an assembly line in Telford, UK. The 12 variants delivered included the LAV-25 (numerically the most common variant), LAV-AT (armed with the same twin-missile TOW launcher as the USMC version), LAV-C2, LAV-AC (Ammunition Carrier), LAV-A, LAV-R, LAV-PC, LAV-AG (with 90mm Assault Gun), LAV-M, LAV-E (Engineer), Radar Carrier (fitted with Rasit medium-range battlefield surveillance radar) and VIP transport.

An even larger purchase was made by the Saudi Army National Guard (SANG) after the U.S. Congress approved a Foreign Military Sales (FMS) program in 1990. This agreement allowed the production of 1117 8x8 LAVs by GM in Canada. Deliveries began in 1994 and continued until around 2003. Two special requirements were larger 500-liter fuel tanks and Michelin 325x85 R16 XML tires with run-flat inserts.

One of the most interesting variants is the LAV-M mounting a 120mm Armored Mortar System (AMS). This Delco weapon system utilizes an automatic, turret-mounted Royal Ordnance 120mm mortar. This breech-loaded recoiling mortar can fire three types of 120mm smoothbore ammunition manufactured by Mecar of Belgium – M530A1 HE, M532A1 White Phosphorous, and M533A1 Illumination. The turret traverses 360° and the mortar can fire up to eight rounds per minute, or four rounds per minute at a sustained rate. The range is 1000-9000m, and 40 mortar rounds are stowed inside the hull.

The SANG has recently been upgrading vehicles of the 43rd Brigade (composed of the 4th and 5th Battalions). The MODA has an option to upgrade the remainder of the fleet, but up till now a decision on this has not been made.



A Nigerian 6x6 LAV at Camp Clara in Monrovia, Liberia, as part of the UNMIL force in 2005. It is armed with a MOWAG Type V 041 twin-MG turret. Propellers at the rear indicate it is capable of amphibious operations. (Mats Hjorter)



An SANG LAV-25 descends a sand dune. It is armed with a 25mm cannon in the familiar Delco turret. The Saudi government maintains a cloak of secrecy around its military, so photos of Saudi LAVs are rare. (Rick Skipper, Khaki Corps Imports)

The first of 499 LAVs (Piranha IIs) in 12 different variants were delivered by GKN Defence of Telford in the UK in 1992. The SANG is one of the largest international users of the Piranha family. It has 1117 LAVs in its inventory, including the LAV-25 variants nearest the camera. (Rick Skipper, Khaki Corps Imports)





This LAV Ambulance belonging to the SANG is bedecked in Red Crescent markings befitting a Muslim country. (Rick Skipper, Khaki Corps Imports)



The Saudi LAV-C2 shares the basic hull of the Canadian Bison, as do USMC and Australian Command vehicles. (Rick Skipper, Khaki Corps Imports)



A profile view of a Saudi LAV-C2. No vehicles have an amphibious capability – this is no great loss when operating in a dry desert! (Rick Skipper, Khaki Corps Imports)



The LAV-AT is the same as the USMC version. The twin-missile launcher is seen here in the stowed position. (Rick Skipper, Khaki Corps Imports)

A Saudi LAV-R. It shares the equipment and design of the USMC version as it rolled off the same GM Canada production line. (Rick Skipper, Khaki Corps Imports)





An AMS of the SANG. This view shows to advantage the unique turret and automatic 120mm mortar manufactured by Royal Ordnance. The turret can traverse 360°. Fans are turned on during operation to create positive internal pressure so the bore evacuator can expel mortar-tube gases. (Rick Skipper, Khaki Corps Imports)



The 40 mortar rounds stored inside the hull of the LAV-M can be fired at a sustainable rate of four rounds per minute. The vehicle's external mirrors are made from polished stainless steel to prevent them from shattering during firing. The 120mm AMS was incorporated into the vehicle by Delco. (Rick Skipper, Khaki Corps Imports)







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